DOCUMENT RESUME

ED 213 107 EA 014 408

AUTHOR Williams, Peter
TITLE Planning Teacher Demand and Supply. Fundamentals of Educational Planning--27.
INSTITUTION United Nations Educational, Scientific, and Cultural Organization, Paris (France). International Inst. for Educational Planning.
SPONS AGENCY Swedish International Development Authority (SIDA).
REPORT NO ISBN-92-803-1079-8
PUB DATE 79
NOTE 103p.
AVAILABLE FROM IIEP Publications, International Institute for Educational Planning, 7-9, rue Eugene-Delacroix, 75016 Paris, FRANCE (Order No. N.13; 12.00 francs). Also available in French edition.

EDRS PRICE MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS Developing Nations; *Educational Planning; Elementary Secondary Education; Labor Turnover; *Long Range Planning; Planning; Prediction; Teacher Employment; Teacher Recruitment; Teacher Responsibility; *Teacher Shortage; *Teacher Supply and Demand; Trend Analysis
IDENTIFIERS *Teacher Surplus

ABSTRACT

Based on the conviction that better and more systematic planning of teacher supply and demand is needed, this study explores the factors determining both the demand for and supply of teachers and presents the measures available to educational planners in their efforts to maintain and achieve a balance. The author argues that creating the capacity to respond to changed circumstances should be as much an objective of educational planners as making accurate forecasts of teacher supply and demand. He demonstrates that the managers of the teaching force, faced by an incipient teacher shortage or surplus, have in fact a wide range of policy options open to them in the recruitment and deployment of teachers. The booklet is intended to provide useful background information to those whose responsibility is projecting teacher requirements. It is part of a series designed for educational planners, administrators, government officials, and policy makers, especially in developing countries. (Author/JM)

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Fundamentals of educational planning

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Planning teacher demand and supply

Peter Williams

Paris 1979
Unesco: International Institute for Educational Planning

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The Swedish International Development Authority (SIDA)
has provided financial assistance for the publication of this booklet

Published in 1979 by the United Nations
Educational, Scientific and Cultural Organization
7 Place de Fontenoy, 75700 Paris
Printed by NICI, Ghent

Cover design by Bruno Pfäffli
ISBN 92-803-1079-8

© Unesco 1979
Printed in Belgium

Fundamentals of educational planning

The booklets in this series are written primarily for two types of clientèle: those engaged in—or preparing for—educational planning and administration, especially in developing countries; and others, less specialized, such as senior government officials and policy-makers who seek a more general understanding of educational planning and of how it is related to overall national development. They are devised to be of use either for private study or in formal training programmes.

Since this series was launched in 1967 the practice as well as the concept of educational planning has undergone substantial change. Many of the assumptions which underlay earlier attempts to put some rationality into the process of educational development have been abandoned or at the very least criticized. At the same time, the scope of educational planning itself has been broadened. In addition to the formal system of schools, it now includes other important educational efforts in non-formal settings and among adults. Attention to the growth and expansion of educational systems is being supplemented and sometimes even replaced by a growing concern for the distribution of educational opportunities and benefits across different regions and across social, ethnic and sex groups. The planning, implementation and evaluation of innovations and reforms in the content and substance of education is becoming at least as important a preoccupation of educational planners and administrators as the forecasting of the size of the educational system and its output. Moreover, the planning process itself is changing, giving more attention to the implementation and evaluation of plans

as well as to their design, and exploring such possibilities as integrated planning, participatory planning, and micro-planning.

One of the purposes of these booklets is to reflect this diversity by giving different authors, coming from a wide range of backgrounds and disciplines, the opportunity to express their ideas and to communicate their experience on various aspects of changing theories and practices in educational planning.

Although the series has been carefully planned, no attempt has been made to avoid differences or even contradictions in the views expressed by the authors. The Institute itself does not wish to impose any official doctrine on any planner. Thus, while the views are the responsibility of the authors and may not always be shared by Unesco or the IIEP, they are believed to warrant attention in the international forum of ideas.

Since readers will vary so widely in their backgrounds, the authors have been given the difficult task of introducing their subjects from the beginning, explaining technical terms that may be commonplace to some but a mystery to others, and yet adhering to scholarly standards. This approach will have the advantage, we hope, of making the booklets optimally useful to every reader.

Preface

Behind the coolly systematic approach that Professor Williams adopts in his examination of teacher supply and demand is a logic that cannot fail to appeal to planners—although its implications, if accepted, would require the use of more complicated planning procedures than have been customary. Briefly, the logic is as follows. Expenditure in education has now reached a point where continued escalation is impossible, retrenchment is likely and greater cost efficiency is imperative. Because education is labour-intensive the cost of teachers consumes the greater part of the education budget. But the cost of teachers is exacerbated by the cost of teacher training and the 'wastage' of trained teachers as they 'drop out' of the profession for one reason or another. Confounding the situation more is the now evident failure of education systems to control the flow of trained teachers, with the result that after decades of shortages there now appears to be in many parts of the world a surplus of teachers.

Professor Williams' logic leads him to argue the case for better and more systematic planning of teacher supply and demand—a solution that will not necessarily commend itself to all planners or educationists. For example, critics will be quick to point out that Professor Williams in advocating 'manpower planning' in education is espousing a cause that has in the past been demonstrably discredited. But Professor Williams has a counter to this and argues pursuasively that the circumstances surrounding teacher supply in public education systems are singularly different from those existing in the competitive markets of the private sector. Furthermore, he

asserts, they are ideal for the appropriate application of considered manpower planning techniques.

The IIEP is delighted that Professor Williams should tackle such an important and difficult issue in the way that he has done. The fact that some may disagree with him is, we think, all to the good. Of recent years the IIEP has come to cherish the idea of intellectual confrontation, believing that it is out of the opposing of ideas that knowledge progresses and balanced judgement emerges.

Professor Williams' book thus ought to appeal to readers of every persuasion. Those who agree with his position will have the added benefit of seeing views clarified and useful mechanisms for action advanced. Those who would oppose it will at least know in detail the shape of their adversary... and the formidable task that confronts them in attempting to reach a 'better' solution.

Michel Debeauvais
Director, IIEP

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Acknowledgments

The author wishes to express his warmest appreciation to Raymond Adams, John Chesswas, Birger Fredriksen, Raymond Lyons, John Mace, Nicholas Summers and David Tanner for their helpful comments on an earlier draft. He takes full responsibility for the document in its final form.

1. Introduction

Aims and coverage

The main aims of this study are:

1. To explore the factors determining demand for, and supply of, teachers.
2. To consider the policy options available to educational planners in bringing about balance between teacher demand and teacher supply.
3. To describe briefly methods of calculating demand and supply of teachers.

A few points about the content must be made at the outset to dispel any possible misconceptions.

First, this is not in any sense an instruction manual on calculating teacher requirements, even though it does outline briefly the data needed and the basic steps necessary for such calculations. Those who wish to pursue the methodology of forecasting teacher needs in greater detail are advised to consult more specialised works.[1]

Second, this is not a book about teacher training as such. It is true that a country's teacher-training institutions constitute its major source of additional teachers. But discussion of teacher sup-

1. See for example Chesswas, John, *Methodologies of educational planning for developing countries*, 2 vols. (Paris, Unesco: IIEP, 1969), especially Vol. I, pp. 23-26, 76-79 and Vol. II, pp. 20-24, 50-56 and 72-79; or Werdelin, Ingvar, *Quantitative methods and techniques of educational planning* (Beirut, Regional Centre for Educational Planning and Administration in the Arab Countries, 1972) pp. 186-202.

ply must range wider than teacher training. It involves consideration of a broad range of alternative teacher recruitment possibilities, and also examination of the factors affecting the flow of people into and out of the profession. In so far as teacher-training programmes do come under scrutiny in these pages, it is their quantitative impact on overall teacher supply, rather than the more qualitative issues of content and philosophy, that provides the focus. Nor, third, is this essentially a study of the rôle and status of the teacher and conditions of service in the teaching profession; these topics are considered only from the point of view of their crucial impact on the quantity and quality of teacher supply.

Fourth, 'teacher' in this volume generally refers to school teachers in the first and second levels of education. The same general principles as apply to school teachers are in fact applicable to the planning of demand and supply of teachers for vocational programmes and for third-cycle institutions; and to the broad field of out-of-school education. Some differences of emphasis in planning teacher demand and supply in these latter areas should, however, be mentioned. Courses and teacher needs in non-school education tend to be more specialised than in schools, offering fewer possibilities of internal substitution of one type of teacher for another. On the other hand external substitution is easier, as individuals may move more freely between teaching and the practice of the occupation in which they are instructing. Also there tends to be less centralization of responsibility for recruitment and training across the sub-sectors of 'vocational education', 'tertiary education' and 'out-of-school education' as a whole. These differences could in fact prove significant for future planning in relation to school teachers. Some observers foresee that school systems themselves will become more diversified and that teachers' roles within the school will become more differentiated. If this occurs, some of the more complex planning problems encountered in respect of non-school teachers may have to be faced also at school level.

Lastly, this book addresses itself to the planning of teacher demand and supply at the level of the education system—national or regional—rather than at the institutional or individual level. The focus on system-wide forces and trends does not however indicate any lack of interest in the welfare of individual teachers or in their concerns and motivations. Indeed the very reverse is the case: good overall management of teacher demand and supply is

essential if serving teachers are to be protected against the threats to their welfare posed by teacher shortage or surplus. The reader is also reminded that planning of teacher demand and supply cannot be regarded simply as a technocratic exercise being undertaken in a political and social vacuum. Planning for the teaching force is necessarily bound up with political decisions: and politics has well been described as 'the art of the possible'. Only if teacher understanding and co-operation are sought will the planner find that some of his proposed solutions are capable of actual implementation. In the author's view it is neither legitimate nor possible to treat teachers and their interests simply as instruments to be manipulated in the pursuit of abstract planning goals.

Although some readers may initially find somewhat curious the notion of 'planning teacher demand' as well as teacher supply, it may be that they will come to recognize the validity of the concept as they read this booklet, more especially the discussion in Chapters III and V. Teacher requirements have no autonomy of their own, but are subject to decisions about educational structures, enrolment rates, pedagogical approaches and grouping of students, school hours and teaching loads, teacher remuneration, and so on. In other words, teacher demand is not an independent force, but is as amenable to management as teacher supply.

Teacher planning and overall educational plans

The planning of teacher demand and supply is a central concern of educational planners. To be sure, the ultimate concern and focus of educational administration, and of educational planning which is a key aspect of it, should be the learner and his learning. And it is also true that the achievement of certain limited instructional objectives through teacher-less systems has become technically more feasible as a result of the continuous development of self-instructional methods and of the adaptation of the mass media for educational purposes. Nevertheless, even where modern gadgetry has been brought in to improve the effectiveness of learning, we still find that in every school system the direct personal contact between pupil and teacher remains the linchpin of the educational process. The effect of the new technical devices in education has thus been not to abolish the rôle of the teacher, but rather to assist it to evolve in a creative way from that of authoritative instruction to

one of facilitation and guidance of the learning process. Indeed the teacher has a crucial rôle to play in organizing and 'orchestrating' the use of the media and learning aids, to give the greatest educational benefits.

In mounting any new, changed or expanded educational programme, therefore, we find that one of the highest priority concerns is securing the necessary teachers for it. Teacher supply has to be planned well ahead. Recruitment for teacher-training courses may have to be undertaken as much as five or six[1] years ahead of the time that trained teachers will be needed in the schools. If the teacher-training programmes themselves have not yet been established, it may require an additional two or three years to build colleges, recruit training staff and design and mount the training courses. This necessity to think well ahead about teacher requirements is one of the major impetuses behind the development of educational planning.

Careful planning of teacher supply is as vital to qualitative as to quantitative change in education. New language policies, revised curricula involving changed approaches or different subject emphases, new equipment and teacher aids all have implications for—and in turn may depend upon—adequate teacher supply, and will make heavy demands upon a country's teacher-training and teacher-retraining capacity. Realistic curriculum planning is intimately bound up with questions of teacher needs and teacher availability.

Particularly in periods of rapid educational expansion, the teacher-training system may itself come to account for a significant part of educational effort and expenditure. It is not unknown for teacher training to absorb as much as 10 or 20 per cent of the Ministry of Education budget, and to account for a high proportion of enrolments at secondary or tertiary levels. Thus teacher supply becomes an important consideration not just as a key input for the expansion and improvement of primary, secondary and tertiary levels of education; but also itself a major competitor for the resources available to the education sector. Such resources being scarce, there may be conflict between the demands for spending on schools and for spending on the teacher-training system. This may be seen as representing the classic economic problem of

1. In some countries, Nigeria for example, the basic primary teacher-training course has been as long as five years.

choosing between present benefits (teachers for the schools now) and future benefits (more and better teachers for the schools, but later); or, in economic jargon, of choosing between consumption and investment. In seeking the optimal allocation of resources between schools and teacher-training institutions, the following kinds of issues must be broached. Are capital and teachers needed more urgently in schools or in teacher-training institutions? For countries with acute manpower shortages what is the trade-off in terms of national social and economic advantage in allocating the best-qualified students between teacher-training colleges on the one hand, and courses leading to the university and other higher professions on the other? If, for example, there is a shortage of well qualified secondary graduates in mathematics and science, how many of these should be diverted from the pressing claims of agricultural engineering and medical training to go into teacher training? Should the manpower needs of science-based occupations be partially satisfied now, or should one starve these professions of entrants temporarily—either by manpower direction or by financial inducement—in order that the quantity and quality of secondary science and maths output may be more substantially improved in five years' time? Planning concerns choices for the future, and in education some of the most difficult decisions concern the proportion of current resources to be invested in securing future teacher supply.

A further reason why teacher demand and supply are so central to the concerns of educational planners is the cost of employing teachers. Their salaries account for an extremely high proportion of recurrent expenditure on education, particularly at the primary level. Changes in the qualifications of teachers or in the pupil-teacher ratio can have enormous impact on the level of the education budget. This point is taken up again on page 27.

Necessity for long-term teacher planning

We have considered some of the reasons why planning of teacher demand and supply is a central concern of educational planners—because the teacher is a key factor in the learning process, because programmes of educational expansion or improvement require forward preparation, because the teacher-training system is itself competing with schools and other educational programmes for

resources, because of the dominance of teacher salaries in educational finance. Since time sequence and phasing are of such cardinal importance in all educational planning, it may be useful to explore in a little more depth how they impinge on teacher demand and supply.

Reference has already been made to the 'lead-time' necessary to mount teacher-training programmes and to put students through the courses. This means that if, for example, new kinds of teachers are going to be needed in the schools in 1990, action must be initiated in the early to mid-1980s to produce them. However, one should beware of exaggerating the extent to which lack of time to train teachers actually prevents short-term growth of enrolment. To do so would be to fly in the face of historical experience. For the world has witnessed in country after country in the 1960s and 1970s extraordinary rates of enrolment expansion *without* the prior thorough preparation of the teachers to staff it. Untrained teachers have been engaged at very short notice and in large numbers for primary and general secondary schools. In the teaching field one witnesses an apparent toleration of the dilution of the professional cadre on a scale that would bring massive protest if it were applied to civil engineers, surgeons or airline pilots. Such dilution is possible only to the extent that the unqualified personnel represent genuine substitutes for trained teachers. It may be that in some of the teacher's rôles—that of the child-minder, for example—relatively full substitution may be effected by employing an untrained person, and it is hard to argue that a particularly lengthy training is necessary for this side of the teacher's job.

Experience has shown that, given the employment situation in most countries of the world and the offer of a reasonable livelihood, enough 'warm bodies' can readily be drawn from the streets or the fields to stand in front of classes as 'teachers'. Some of these hastily recruited, inexperienced and untrained teachers have done a splendid job in more than just a child-care sense, raising questions indeed about the appropriateness of the structure and content of traditional teacher-training programmes to the actual classroom job of the teacher.

But successful as these makeshift arrangements may have been in increasing school attendance, the question is how far the quality of education, in terms of pupil learning, has suffered. Educationalists will strongly challenge the view that without special preparation

'anyone can teach' well; and will argue that the professional skills, knowledge and motivation required by teachers are specific to the profession and can be acquired only through teacher training. Recent studies by the Institute of International Education in Stockholm lend support to the view that in developing countries teacher effectiveness is associated with the amount of training received.[1] On the other hand there are those who question the cost-effectiveness of teacher training in developing countries.[2] The resolution of this issue is complicated by the fact that in many countries teacher-training courses contain a large element of general education which is not specific vocational preparation for teachers. In so far as such general education is also obtainable outside teacher-training institutions, lead-times for teacher supply could be reduced, by confining teacher-preparation courses to the vocational elements only. Of course, not all teacher-educators would agree that the advantages of reduced lead-time would compensate for what they would see as pedagogical disadvantages of divorcing general education from vocational preparation. Another way of reducing lead-times, and one which is enjoying growing popularity, is to admit to teaching persons with minimal professional training and provide them with the necessary professional courses on an in-service basis.

Sequence is important in education planning, not only for the long lead-times required to bring about change, but also for the long 'lag-times' over which past decisions have their ineluctable effects. Nowhere is this more evident than in the structure of the teaching force. In taking on large numbers of poorly qualified and unqualified teachers to make possible rapid enrolment expansion, the education authorities should remember that just as problematic as the lead-time of several years to produce trained teachers, is the lag-time of maybe forty years over which teachers may remain in the teaching force.[3] If they have not been well trained, or have

1. Husén, Torsten, *New patterns and structures of teacher education.* Address at Institute of Education, University of London, November 1977 (to be published).
2. World Bank, Education Sector Working Paper. Washington, D.C., 1974, p. 36.
3. This point was expressed rather strikingly by the Ghanaian Minister of Education, who in 1970 told Parliament 'Sometimes I think we are all of us too impatient for sudden change and do not sufficiently recognise that basic improvements take a long time to produce results in education. Some of the teachers who taught me in the 1930s and 1940s received what education and training they had at the end of the last century ... Equally we are now training young teachers in our colleges who will still be teaching in the year 2010 A.D., when

been trained in skills or subject areas which become obsolescent, then the system—its schools and its students—must suffer from this weakness for decades, since the authorities have a tacit if not indeed an explicit obligation to employ them until retirement. Something can be done for inadequately trained teachers through retraining and in-service courses, but a basic deficiency of educational background is almost impossible to correct entirely at a later stage.

As regards untrained teachers, serious time-lag effects have often been mitigated by high rates of wastage and turnover among such teachers. This is particularly true of newly hired young teachers who may be given only temporary appointments and may then have to choose between taking regular training, possibly on an in-service basis, and leaving teaching altogether. In turn, young people may themselves see teaching only as a temporary staging-post, which will give them the opportunity to improve their qualifications through part-time study or to look around for other more remunerative employment. The older untrained teacher, while often competent and experienced, represents a potential longer-term burden that the system may carry for decades, with many older teachers lacking the potential for further professional development, and their employers reluctant or unable to terminate their services.

The seriousness of lag effects will depend largely on whether the teacher force is expanding, and on the pace and evenness of such growth. In this connection one should contrast systems experiencing rapid and steady growth with those undergoing uneven development. In the first case, a continuously expanding system can overcome lag effects by taking advantage, in its recruitment policies, of the rising levels of educational attainment in the population. The level of educational and professional qualifications of the teachers can gradually be raised, and a steady flow both of vacancies for new recruits and of promotion opportunities for existing teachers will be available. The older less adequate teachers will come to form a steadily diminishing proportion of the teaching force.

The above situation should be contrasted with one of imbalanced growth in the teacher force of the kind that many of the world's education systems have recently been experiencing. In some of the more developed countries this has been due to a profound demo-

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Hon. Members and I will long be gone; and their young pupils in that year may still be working in A.D. 2070, a hundred years from now.'

graphic change, with birth rates swinging abruptly from growth to decline. Enrolments have thus stabilized or fallen, causing a consequent drop in the required number of teachers. In other countries, including many developing countries, enrolments and teacher needs are still growing but at a slower pace than hitherto. The problem for many of them arises from the fact that the teacher-training system was expanded to cope with an exceptional level of annual requirements when enrolment ratios were rising strongly and there was a need to replace unqualified teachers or expatriates. Once this phase passed, they were left with teacher-training capacity far too large for their regular continuing needs, which are basically to make good wastage and cater for the effect of population growth. In some countries the lessening of teacher demand has been partially due to restructuring of education, with some stages being shortened by one or more grades. Others, confronted by economic recession, have had to retrench on educational expansion for financial reasons. The inexorable rise of teachers' salaries, in particular, has made it difficult to sustain rapid growth of the teaching force.

So much for the causes. The consequences of a very uneven rate of development of teacher supply can be far-reaching and serious, especially when a period of heavy teacher recruitment is succeeded by one of slower growth in the size of the teaching force. A typical situation, particularly among newly independent countries, has unfolded in the following way. A rapid expansion of primary and secondary schooling has been launched rather abruptly, often in response to a sudden surge in popular demand, before good-quality output from the higher levels of the school system is available for training as teachers. In these circumstances trainees of very limited educational background—sometimes with only a completed primary education—have been enrolled on 'crash' courses in hastily constructed teachers' colleges, staffed by relatively inexperienced tutors. In addition many unqualified teachers have been hired. With the passage of time the problem recedes somewhat, for two main reasons. First, teacher-training capacity, and output of trained teachers, rise strongly and this begins to make inroads into the ranks of the untrained. Second, for the reasons outlined in the previous paragraph, demand itself may moderate. In consequence whilst the overall *stock* of teachers continues to rise, albeit more slowly than hitherto, the annual required *flow* of newly trained teachers severely diminishes.

Two serious consequences follow. In the medium or even short term the teacher-training system must stabilise, or even contract. This is so despite the fact that it can now attract a much better level of recruits than before—perhaps now even with upper secondary education—and will thus actually have to turn away candidates for training who would have been welcomed with open arms only five or ten years ago. Ironically, too, the need for contraction may come just as the teachers' colleges have at last obtained tutors and buildings of the required quality. A number of countries in both more and less developed regions of the world have experienced this dramatic transition from rapid expansion to savage retrenchment.[1] In such countries the recent period of closing colleges and reassigning tutors has been in melancholy contrast to the carefree manner in which new places were created and new appointments made only a decade ago.

Second, long-term difficulties in the structure of the teaching force will result from the uneven growth of teacher supply. Imbalance in terms both of age and of quality may come about. For the implication is that large numbers of teachers are admitted to the teaching force at a time when educational requirements and training course quality are somewhat low, and have then been succeeded by smaller groups of teachers of much higher education and better professional training. For both groups the slowing down of expansion of the teaching force will result in far fewer promotion opportunities than their predecessors enjoyed, and if promotion is on the basis of seniority rather than merit there is a particularly serious danger of loss of morale among young teachers. For the authorities a slow-growing teacher force gives rise to many more problems than does an expanding one, particularly in attaining a good distribution of staff between individual schools, school districts and subject specialisms. The distorted age-structure will also cause problems when the teachers come up to retirement age. The pattern of retirements will reflect the earlier uneven rate of recruitment, so that 'stop-go' (and 'go-stop') recruitment policies can produce ripple effects in the teacher force that may still be felt a generation or so later.

1. See Freeman, R. B., *The overeducated American*, New York, Academic Press, 1976. Also Williams, Peter, 'Too many teachers? A comparative study of the planning of teacher supply in Britain and Ghana', in *Comparative education*, Vol. 13, No. 3, October 1977.

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The foregoing discussion of the length of lead-times and lag-times in teacher demand and supply underlines the need for the exercise of foresight, and for a long time-horizon, in teacher planning. Whilst long leads and lags offer the planner some measure of certainty and predictability which he may find helpful, they also constitute his greatest challenge. For educational planning involves efforts to shape the future of an education system to respond to the evolving needs and aspirations of society. There is thus a need for flexibility and for finding ways of overcoming or circumventing the constraints which long lead- and lag-times impose.

Teacher planning and manpower planning

Teachers represent a category of skilled manpower, and one can regard the planning of teacher demand and supply as a branch of manpower planning. That part of manpower planning which is known as manpower forecasting has gone somewhat out of fashion since its heyday in the late 1950s and 1960s. At that time part of the popularity of manpower projections derived from the fact that they frequently indicated the need for educational expansion, thus legitimizing from an economic standpoint educational policies which governments also wished to pursue for social and political reasons. Moreover this was for many countries the post-independence period, and there were clear priorities of localizing jobs held by expatriates in the face of an extreme dearth of well-educated nationals of the countries concerned: manpower forecasting was essential for this task. To a large extent this political impetus behind manpower forecasting has now lost its force. This, together with a lack of success with the use of manpower forecasts in practice, and the powerful theoretical criticisms which have been made of it, may account for the declining fortunes of this technique.

In the manpower requirements approach to the planning of education, manpower needs are often derived from the overall national output target, normally laid down in a country's development plan. This target is broken down into separate sectoral targets of output for the different economic sectors (transport, agriculture, industry, banking and commerce, communications etc.) and social sectors (housing, medicine, education etc.). The target level of output in each sector or industry is then converted—by applying an output-labour ratio—into a manpower requirement, consisting of numbers

of workers in each occupation required to produce the output. The ratio used for the calculation may reflect existing practice in the country's employing establishments, as revealed by manpower surveys, with some adjustment—based on observed trends in labour productivity or on comparisons with technologically advanced industries or countries—to take account of expected future technological developments. In this way one can translate a target level of output (e.g. so many million tons of steel) into future required stocks of workers in various occupations (metallurgists, blast furnace men, office clerks etc.) in each sector. The manpower needs in the different sectors are then totalled to show requirements by occupation for the whole economy in successive future years. These target stock figures must then be converted into required recruitment of new workers during the Plan period. The number of recruits needed has three main components. There will be first an overall growth factor representing the difference between the target numbers and the present numbers in each occupation (as ascertained from employment statistics or from a special manpower survey of the labour force); second, provision for regular attrition due to resignation, retirement, death, etc.; and third, any allowance for replacement of any existing workers who are regarded as temporary or underqualified.

These skilled manpower requirements are then converted into educational equivalents, signifying the amount and type of education and training that workers in each occupation should have. Finally the total educational requirement has to be turned into an educational plan specifying enrolments in and outputs from the various education or training courses in each year of the Plan period; and the necessary investments of buildings, equipment and teachers have to be programmed and budgeted.

The aim of the manpower requirements approach to educational planning is to ensure that educational output matches the occupational needs of the economy as closely as possible. If successfully applied, it ensures on the one hand that manpower bottlenecks, in the form of an unforeseen lack of trained workers, do not impede development, and that from a manpower point of view all the Plan targets are realizable; and on the other hand that the education system does not over-produce categories of educated or trained personnel unable to obtain employment.

One can readily see how this model can be applied to teacher

planning. The 'output target' for the education sector is frequently expressed in terms of a desired level of enrolments. It is not difficult to apply the established pupil-teacher ratio—education's version of the output-labour ratio—in order to calculate total future teacher requirements, and to convert these into educational requirements by using the current teacher certification rules.

The criticisms that have been made of the manpower requirements approach are too many to enumerate here, but the most formidable ones centre around the fact that it is a technological rather than an economic approach. It appears to assume that manpower requirements are technically predetermined by given levels of required output, and that the cost of producing or employing such manpower is largely irrelevant, since there is only one technology and one combination of skills that is appropriate. However the evidence does not confirm this supposed absence of alternative technologies, with labour requirements rigidly predetermined by output targets. In fact inter-firm comparison studies have shown that for many products a good deal of substitution is possible between capital and labour and also that it is quite feasible to use different mixes of occupational skill to produce the same product. Criticism is also directed at the assumption that occupation-education relationships are fixed, and that there is for most occupations any necessary close correspondence between possession of occupational skills and prior completion of particular courses of study and training. The critics point out that in the real world there is more than one route into many occupations (e.g. salesman, managing director) and that individuals in any case acquire their skills in a variety of ways, including learning on the job. Apart from these and other theoretical objections, there are also serious practical and technical problems in defining occupations accurately, estimating current labour-output ratios in each sector, and so on.

How far do these objections to the manpower requirements approach apply in respect of teachers? We may identify a number of respects in which the position of teachers is rather special, suggesting that the objections to manpower planning may apply less strongly in their case.

1. The productive system in which the teacher works is technologically rather simple. The amount of capital equipment used is rather small, and efforts to substitute capital for teachers on any large scale have been confined to a few isolated experiments.

Teachers combine rather minimally with other occupational groups in doing their work. In education there is very little division of function between full professionals and sub-professionals, of the kind encountered in medicine with its large support staff for doctors. There is some specialisation of function —e.g. on a subject basis—between teachers themselves, but this does not operate at all levels of the system. For these reasons the questions of alternative technologies and alternative occupational combinations—despite their immense theoretical significance—assume less practical importance in teacher forecasts than in those for other occupations.

2. Following on from the foregoing, given the relative simplicity of the 'production process' in education and the comparative ease with which pupil-teacher ratios may be calculated, it is in practice not too difficult to agree on appropriate output-labour ratios to be used in making forecasts of requirements. This certainly does not mean that the ratios used are necessarily optimal: they appear to be arrived at as much by convention as on the basis of any evidence of their efficacy in promoting learning.
3. The other pivotal link in manpower requirements calculations—that between occupation and education—is also less challenged in teaching. The rôle of the teacher is widely understood as being largely concerned with the transmission by the teacher to the younger generation of the knowledge and skill which the teacher acquired through his own education. This gives a certain persuasiveness to the argument that a teacher's fitness for his job can appropriately be measured quite largely in terms of his qualifications.
4. The rôle of market forces in the education system is somewhat limited in all countries, even where (as in countries such as the Philippines for example) there is a large private sector. In some countries schooling itself is not bought and sold at all, and in consequence the public authorities constitute a monopsonistic buyer of teachers' services. Moreover the public authorities also often control teacher supply itself, because they own or finance teachers' colleges, and fix or negotiate teachers' salary levels which then apply to all teachers of a given grade. In such situations prices will not be self-adjusting to reflect changed supply-demand relationships, nor could one expect teacher supply and

demand to be very responsive to changes in price. The case for manpower planning is strengthened in these circumstances.

5. A useful by-product of the above situation is that manpower forecasting for the teaching profession starts from a sounder data basis than in the case of most other occupations. With a limited range of employers for teachers, and all school teachers (unlike, say, accountants or personnel managers) employed in just one sector of the economy, employee records should provide reliable information about the stock of manpower currently employed.
6. The relative ease of predicting over the medium and short terms the size of the education system and of educational output should make manpower forecasting for teachers liable to relatively small margins of error on the demand side. This is particularly true of countries with enrolment ratios approaching 100 per cent of the school-age population. But even in other countries short-term projections are based largely on survival rates for pupils already enrolled. However, because both births and school intake rates are notoriously difficult to predict with any accuracy, a very marked reduction in the accuracy of forecasts of educational enrolment will be experienced as one extends the horizon from short- to medium- to long-term forecasting, and very long-range projections of teacher supply and demand (the fifteen years advocated by some manpower forecasters) would probably not prove useful.

The foregoing constitutes a strong case for the application of manpower forecasting techniques in educational planning. What most strikes the observer as surprising is not that so many countries try to make forecasts of teacher requirements, but that, despite the relative simplicity of making manpower forecasts in education, teacher supply planned on this basis has in so many cases been wildly out of line with actual demand.

Any balanced evaluation of the use of manpower forecasting techniques in the education sector itself must pinpoint three main areas of reservation about its usefulness. The first concerns the substitution issue and how far there are knowledge and skills specific to the teaching profession, which can be obtained only through teacher training. If in fact there is very little specific professional content in the teacher's job, then the case for manpower planning is weakened: for such a situation suggests that vacancies can be filled at short notice by untrained teachers. The practice of many

educational administrations—in the way they staff schools or calculate teacher/pupil-teacher ratios, for example—suggests that they do regard untrained teachers as in some respects more or less full substitutes for trained teachers. This then calls into question the whole manpower forecasting approach with its assumption of long supply lead-times, and fixed output-occupation-qualification-education relationships.

The second reservation arises from the difficulty of specifying output in the educational field. One approach to educational output sees school attendance itself, and the experiences of the student in school, as the output of the system. In this case it might well be that teacher qualification was of less significance than if the main alternative definition of output—in terms of educational achievement by pupils—was adopted. If the expected outputs of the education system could be closely specified, a basis would exist for testing the manpower forecasting approach hypothesis, namely that there are extremely limited or nil possibilities of substitution between the factors of production. One could then enquire whether—if combined in a different way—educational inputs (teachers, other personnel, buildings, equipment, materials, student time and student abilities etc.) could produce the same rise in educational achievement by students, but at less cost. Many recent education production function studies have been attempting to discover just this. It may be, however, that neither approach to defining output is correct on its own; and that education in fact has multiple output objectives, in some cases complementary, and in other cases alternative. According to the objectives specified, required teacher inputs would vary.

The third reservation, applying to all manpower forecasting but particularly to teachers, concerns the difference between teacher qualification and teacher quality. Manpower forecasting is not itself responsible for the confusion of these two terms, but does tend to direct attention towards formal, measurable attributes of teachers. One should not allow concern with qualifications to obscure the importance of quality, in terms of character and motivation of teachers, as well as of their ability levels. It is a fact that in many countries teachers are better qualified than ever before, but are now often drawn from lower strata of ability in the population than previously and are not necessarily superior to their predecessors in terms of dedication.

Financial considerations

Both the demand for teachers and the supply will be closely affected by financial considerations.

On the demand side the number of teachers required will of course be the product on the one hand of enrolments, and on the other of the pedagogical arrangements, expressed through the pupil-teacher ratio. But these are not autonomous variables; they are dependent on public policy: and in fact public policy towards levels of school admission and pupil-teacher ratios will largely reflect the level of education costs in relation to the total amount of funds that a country is ready to devote to the educational budget. Additionally the cost to parents of sending their children to school may have an important bearing on enrolment levels and hence on teacher requirements. The distribution of educational costs in the public school system between the public authorities and parents is also largely the outcome of public policy decisions.

Because education is so labour-intensive, and teachers form such a high proportion of the labour force in education, teachers' salaries account for a high percentage of the education budget. The salary bill for a teaching force of any given size (remembering that the size of the teaching force is itself largely determined by the cost of employing it) depends on three factors—the level and gradient of the various salary scales applying to teachers, the distribution of teachers between scales, and the distribution of individuals on each scale.

Generally speaking, at early stages of economic and social development there is a tendency for teachers' salary levels to represent quite a high multiple of national income per head, and for salary differentials paid in respect of additional amounts of education and training to be large. This is a natural reflection of the scarcity of educated people. It is also the case in a period of rapid educational expansion that, where levels of pay reflect qualification, a high proportion of the teachers will initially be on the inferior scales, reflecting their low levels of education and training; and in these fast-expanding systems the majority of teachers will tend to be young and somewhere near the bottom of their pay scales. For these reasons many developing countries have been able to launch programmes of rapid educational development with an initial teacher cost per pupil that is surprisingly low.

But teacher costs per pupil are almost certain to rise rapidly, even if pupil-teacher ratios do not change, and even if teachers' salary scales can be held constant, at least in real terms. The main reason is that as educational development takes place, one witnesses 'qualification inflation' in the shape of better candidates coming forward for teacher-training courses, so that there is a progressive shift of the composition of the teaching force from the lower to the higher salary scales. The trend will be accelerated if unqualified teachers are being replaced by qualified. The effect is particularly strong in those education systems where teacher salaries are differentiated more by level of qualifications than by level of responsibility of the teaching post held. A subsidiary reason for increased teacher costs is the gradual ageing of the teaching force when the period of most rapid education expansion is past its peak. This produces a rise in the salary bill through 'incremental creep', reflecting the fact that the 'average teacher' salary point moves from the lower towards the upper end of the scale.[1]

For the above reasons there is a built-in cost escalation in the teachers' salary bill irrespective of any change in the level of enrolments or of salary scales. The education authorities may therefore find themselves in the difficult situation of having to hold down the salary bill by measures which they believe to be injurious to good education. They may for example decide to raise the number of pupils per teacher, thus restricting the volume of teacher employment: or they may deliberately decide to give preference in recruitment to less well educated teacher-candidates because they will be cheaper to employ.

Salaries also influence teacher supply in the more obvious sense of supply of candidates for training. Of the many considerations that influence the career choices of job-seekers, salary levels are probably the most important. The level of the starting salary in teaching in relation to that in other careers is particularly crucial in determining the quality of recruit that can be attracted to teaching. But one should note also that the structure of salary scales and promotion prospects, which together largely determine lifetime earnings, may also have a significant impact on decisions to enter,

1. For an example of the working of the factors outlined in this paragraph, see Chesswas, John, 'Tanzania: factors influencing change in teachers' basic salaries' in *Educational cost analysis in action: case studies for planners—I*, Paris, Unesco: IIEP, 1972.

or remain in, the profession. These salary considerations may affect women differently from men. Since women often have fewer alternative job opportunities outside teaching open to them, a system of equal pay for women and men may in fact make teaching *relatively* more attractive to women than to men. In other words, a given salary may attract women of an ability higher than that of the men it attracts.

II. Definitions and concepts

Before examining in detail the demand for teachers (Chapter III) and the supply of teachers (Chapter IV) it will be useful to draw attention briefly to some of the ambiguities of definition that can arise, and the crucial distinction between the stock and flow of teachers.

Who counts as a teacher?

In making estimates of the numbers of teachers needed and of those available one should be clear as to who is to be counted as a teacher. Variation between education systems in their practice can make things awkward for international comparative purposes, and Unesco has tried to establish agreed standard definitions. At the national level the important thing is that whatever definition is chosen should be clear and consistent between regions and schools, and from one year to the next.

A major ambiguity may concern the question whether 'teachers' will be taken to be all working members of the teaching profession or only those who are actually teaching in the classrooms. The difference between 'teachers' and 'current classroom teachers' could reflect one of the following situations:

1. Some teachers may in fact be on long-term release for in-service training or study leave, or may be seconded/delegated temporarily for other duties, including service abroad (quite important in the case of countries such as Egypt, for example).
2. Teachers who are attached to an institution may be absent for short courses, sick leave, maternity leave, etc.

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3. The staff establishment of a school or college may make provision for teachers to do non-teaching duties, for example institutional administration, research, librarianship or careers counselling. Are the staff holding these posts counted as separate cadres or as teachers? Unesco's definition of a teacher runs 'a person directly engaged in instructing a group of pupils (students). Heads of educational institutions, supervisory and other personnel should be counted as teachers only when they have regular teaching functions'.[1] If teaching personnel who are in service but temporarily not teaching are to be treated as non-members of the teaching force, rather than as part of current teacher supply, then more sophisticated data will need to be kept of the flows of personnel between teaching and non-teaching educational work. If on the other hand they are included among teachers in the statistics for the teaching force, the estimates of requirements will have to be inflated, and assumed pupil-teacher ratios deflated, to take account of this fact.

At the outset the planner should define the scope of his teacher planning. Is this to embrace all teachers regardless of where they teach? In such case he will be as concerned with teachers in out-of-school literacy classes, in a government department, in the training school of a parastatal enterprise, or in a private school as with those in public schools. Very frequently the term 'teacher' is administratively defined to include only the last group. The narrower the definition of the educational system for which teacher supply is being planned, the more necessary it will be to take account of mobility between teaching jobs in the narrower and wider education systems.

Another potential ambiguity concerns the difference between individuals who teach and the number of full-time teaching posts. To the extent that teaching may be a part-time occupation there will be more teachers than teaching posts. It is common in some parts of the world—in many Latin-American countries for example —for a high proportion of teachers to be recruited on a part-time basis. There are all kinds of possible reasons for this. It may be dictated by the structure of the education system, which relies on multiple shifts or offers many part-time courses for people in employment. Or the structure and organization of the curriculum may

1. Unesco, *Recommendation concerning the international standardization of educational statistics*, Paris, 1958.

compel the smaller school to employ teachers for specialist subjects —say, music or languages—only on a part-time basis, because its total timetable load in these subjects is not enough to warrant employment of a full-time specialist teacher. These needs on the part of the system may coincide with the preferences of the would-be teacher, who may wish to combine part-time teaching with another full-time paid job or, in the case of married women, with running their home. When aggregating teacher requirements or teacher supply it is important that those teachers not carrying the specified full teaching load be converted for statistical purposes into 'full-time equivalent' teachers. Thus a teacher who teaches two days out of five on the school timetable would count as two-fifths of a full-time teacher.

Ideally, too, when estimating the supply of teachers it would be useful to find out how many individuals perform more than one teaching job—two part-time jobs for example, or a full-time job in the day and a part-time one in the evening: for apparent shortages are often made good in this way. However, only a rather sophisticated records system could generate such information.

Next, in considering supply, we need to know how non-regular members of the teaching force are treated. In some countries expatriates still account for a high proportion of teachers at secondary and higher levels. Are they included as part of the permanent supply or not? What about other contract and temporary teachers? How are the underqualified and unqualified treated? Generally speaking it seems best to distinguish between those on permanent terms of service and those only temporarily employed. The long-term aim of most education ministries will be to have most of their teachers on permanent terms of service. Therefore in projecting requirements it is necessary to make provision not only for 'wastage' among the permanent teachers, but also for planned replacement of those only temporarily employed. However it does not necessarily follow, as we have already noted, that because a teacher is unqualified or underqualified he is a non-permanent employee.

Level of aggregation

The level of aggregation being used in planning for teachers is of the greatest practical importance. The more differentiated the categories of teacher one needs to identify, the greater the complexity

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involved, because a disaggregated approach compels one to take account of movement between categories within the teaching force. The major categories in which one may be interested are sex of teacher, age, qualification, nationality, teacher's language group, subjects he is teaching; and this information should be cross-referenced with school details about level (primary, etc.) and management (government/local authority/religious/private, etc.). While a teacher may be expected not to change nationality (or sex!) from one year to the next, a switch between private and public sector schools may be common; and upgrading of qualifications, or a move from the primary to the secondary level, may be part of the accepted way in which teachers make progress in their careers.

A related problem when a high level of differentiation is sought, is that the same teacher may fall in more than one category in a single year. This is particularly obvious in the case of teaching subject classification. For example a secondary school teacher may teach ten periods of mathematics per week, eight of physics and three of religious studies. Under which subject heading(s) should he or she be placed? The choice is either to classify the teacher only by 'main subject taught' or else to have a highly sophisticated data-recording system which identifies fractions of a full-time teacher for each subject. The same issue arises in relation to teachers' subject qualifications, bearing in mind that it may be deliberate policy to prepare teachers to handle more than one subject in the school curriculum. A similar problem might occur with a public school teacher teaching part-time in a private institution.

The simplest level for which to estimate teacher demand and supply ought to be the primary level, because of the lack of specialisation among primary teachers. Specialisation by subject tends to begin in the lower secondary or middle grades. But even at primary level one may well need to distinguish between teachers of different language groups, if several media of instruction are used within one country. At secondary and higher levels, on the other hand, the complication of different branches and subject specialisations immediately arises. A countervailing point in many developing countries, however, is that the size of primary-school enrolment is far less within the control of government than that of secondary-school enrolment. This is because at primary level, in countries without effective compulsory attendance, and no fixed age of entry, the enrolment ratio largely reflects parental attitudes

and decisions. At secondary level on the other hand a selective system will imply that private demand exceeds the supply of places and ensures that all places on offer in the public system will be taken up. In these circumstances the main area of uncertainty at secondary level is the amount of 'overspill' into private secondary schools that must be allowed for.

Usually countries plan teacher demand and supply at primary level separately from secondary, because the educational background and training requirement which they demand for primary and secondary levels are quite distinct from one another. With the development of education systems and rise in levels of income, these distinctions become more blurred however; in some highly developed countries the primary schools can recruit university graduate teachers, or even those with higher degrees. There may then be little differentiation in the training courses for, and qualifications awarded to, primary and secondary teachers, and teacher demand and supply for the two levels may be planned jointly. This makes the planning of provision of subject teachers for the secondary level more complex.

A country which wants to be in effective control of its teacher situation will clearly want to plan in some detail. This involves analysis of the present teaching force and the planning of new supply on a categorised basis. Wastage rates often differ greatly between men and women teachers, and between teachers of different specialisations and qualification levels; so that highly aggregated levels of analysis may yield misleading results. Some education systems find themselves with an overall surplus of trained teachers, yet a severe shortage of mathematics, science and applied subject teachers, and this kind of problem can be tackled only with a disaggregated approach. Of course the finer the detail required, the more elaborate the teacher record system needed. Compromises will have to be found between what the planner would ideally like to know, and what data can be collected and analysed at reasonable cost. The degree of sophistication of data collection on teachers must be geared to the national situation in each case.

Needs, requirements and demand

'Teacher demand' may have several different meanings, which it is important to distinguish. First, it may connote 'needs', used rather

loosely in a layman's sense to refer to what is desirable. Thus one may say that a school or education system needs more teachers, meaning that for them to have more teachers is a desirable end in itself. This should be distinguished from a second more instrumental interpretation of 'demand' as 'requirements'. In this case demand for teachers is being defined in manpower planning terminology as the numbers technically necessary to produce a certain specified output from the education system. Without teachers of a certain number and description, the output target could not be attained. When the official in an education ministry's planning office speaks of teacher demand, his meaning is often a mixture of the layman's and the manpower forecaster's usage. He is often referring to the number of teachers needed to service a given number of pupils at some stated pupil-teacher ratio. This ratio is often itself an education policy target rather than a technically specified input necessary for the achievement of stated pupil behaviours.

Much of the discussion of demand in this volume is in the above rather pragmatic sense. There is however a very important third sense in which 'demand' is used. Economists understand demand to mean market demand. To an economist the 'demand' for teachers is a function of the price of teachers and it signifies the number of teachers that employers are prepared to hire for work at current pay rates. The economist draws our attention to the fact that in a world of scarce resources the amount of any commodity or service, such as teaching, that consumers are prepared to buy, depends on its price. If teachers' salaries rise relative to other prices in the economy then, other things being equal, fewer will be employed.

Teacher shortage and teacher surplus

Arising directly out of the foregoing discussion is the point that a shortage of teachers in a technical sense—i.e., insufficient teachers to enrol all children wanting school places or to staff the schools at what are considered desirable educational standards—could well coincide with a surplus of teachers who cannot get employment because at present wage rates and given the present state of the government's budget nobody can employ them. It is equally possible for a situation to exist in which a requirement has been identified by employers, and there are trained persons physically available to fill such vacancies; yet the price which would bring supply and

demand into equilibrium is not offered. The 'shortage' thus reflects an unwillingness by government to offer the market rate for teachers' skills. Thus we see that the 'technical' and 'economic' definitions of surplus and shortage will often differ.

It is also salutary to remember how very dependent the notion of 'shortage' or 'surplus', in the non-economic sense, is on the assumptions used about acceptable standards. A 'shortage' may appear quite pronounced if teachers possessing a certain qualification are defined as being unacceptable: but non-existent if they are recognised as adequate. In the same way a 'surplus' of teachers when the pupil-teacher ratio is 35:1 could be redefined as a 'shortage' if a new target of 25:1 were set.

Associated with these different definitions are many alternative ways of measuring the extent of teacher shortage. The most straightforward one would be the number of vacancies existing in schools, indicating that the necessary complementary resources in buildings, equipment and materials were available and that lack of teachers was the bottleneck preventing these resources being brought into use. However, shortages in this absolute sense are usually prevented from manifesting themselves by employment of unqualified or underqualified teachers. Thus alternative measures of teacher shortage might be the number of underqualified teachers employed, or the number of qualified teachers having to teach subjects other than those in which they were trained.

Stocks and flows of teachers

In all manpower planning there is a crucial distinction to be made between the *stock* of manpower in service, and *flows* of manpower, which represent additions to the stock and depletions from it through recruitment to and loss from the occupation in question. An excess of recruitment (inflow) over loss (outflow) produces increases in the stock, and vice versa.

The teaching force represents the current stock of teachers and the future size of the teaching force will vary with changes in the number of pupils and in the pupil-teacher ratio. The inflow of teachers—recruitment—consists of new teachers from the teacher-training system, untrained teachers recruited, and former teachers attracted back into the profession from other jobs, from courses, or from various forms of approved absence. The outflow (teacher loss)

results from death, retirement, resignation, approved temporary absence and so forth. It is worth noticing, and we will return to this point, that there is more than one source of inflow and more than one type of outflow.

The aim in teacher planning, as in other forms of manpower planning, is to achieve a long-term equilibrium between inflow and outflow such that net teacher flows are equal to the required changes in the level of the teacher force (stock) which enable the stock of teachers to satisfy the projected level of demand. Problems of attaining a balance between teacher demand and supply are discussed in Chapter V.

III. The demand for teachers

In the light of the distinction made at the end of the previous chapter between the *stock* of teachers and the *flow*, teacher demand will be looked at under the same two heads. First the determinants of the required stock of teachers are considered; and the discussion then moves on to consideration of the teacher flows required to maintain, increase or diminish the stock, as found necessary.

The required stock of teachers (size of teaching force)

Basically the total size of the teaching force can be represented as the product of two factors,[1] which are (i) the number of learners to be enrolled, and (ii) the teaching technology in use, resulting in a pupil-teacher ratio. Neither of these factors is altogether technically predetermined; each is largely amenable to policy decision, with a range of alternative choices available to the policy-makers. The choices made will reflect the social and cultural values of a society and the strength of different interest groups; and they may also be influenced by the climate of international opinion. They will very much depend on economic factors—the cost of educational inputs and, in particular, of teachers' salaries; the share of the total cost of education that government is to meet from public resources, and the size of the private sector in education; the overall resource

1. Technically, one ought also to add a third, quantitatively much less important, factor. This is the number of places in the teaching force reserved for teachers not on teaching duties in the schools. They may be on in-service courses, or delegated to other duties, or perhaps belonging to a force of 'supply teachers' not attached to schools but available to cover for absences.

availability, both public and private, for educational purposes; and the assessment made of the contribution that education will make to economic growth.

1. Number of learners to be enrolled

This is the product of three key variables: (i) the ages and length of attendance prescribed; (ii) the population of school-going age; and (iii) the enrolment ratio.

(i) *The ages and length of attendance* are prescribed by a country's school structure and its educational laws and regulations. Practice on those matters varies enormously between countries. Some countries have only three grades at the primary stage (e.g. Nepal) and others have as many as eight (e.g. Malawi); the age of entry in some countries is 5, in others 6, 7 or 8, while many countries in practice permit entry at many different ages; some countries have compulsory school attendance, others not; and the length of compulsory education varies enormously.

(ii) *The population of school-going age* (the population in the age-group designated as corresponding to any particular educational stage) sets a theoretical ceiling on the level of enrolments in that stage. In practice, however, this ceiling may be exceeded if there is under-age or over-age enrolment or if there is much repeating.

(iii) *The enrolment ratio* represents the proportion of the relevant age-group which is actually enrolled in school. It reflects both the intake rate and progression (promotion, repeater and drop-out) rates. These are importantly affected by government policies of two kinds. First, there are policies to determine or influence the demand for education, e.g. whether education is to be made compulsory, whether legal provisions regarding compulsion are actually to be enforced, whether education is to be fee-free for the students or not. It will be clear from this list that demand is not a factor entirely independent of government control. The second set of policies are those on the supply side, affecting the number and type and distribution of places actually made available. Included among these supply policies are the rules ministries of education make about under-age and over-age entry, and about repeating.

However, enrolment ratios reflect at least equally importantly the response of parents and pupils to the opportunities available for education. Factors causing a weak response, i.e. low enrolment, include economic difficulties (direct costs and labour services or

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wages foregone through school attendance), cultural and language barriers, problems of physical access, unattractiveness of the education offered, and so on. Because of non-entry and drop-out, net enrolment ratios (proportion of children of 'correct' age attending school) are often below 100 per cent even where sufficient places are available for all to attend school. Conversely however, as is well known, gross enrolment ratios—which relate all pupils enrolled in a school stage regardless of their age to the size of the population of 'correct' age—may exceed 100 per cent if there is wholesale repeating or under- and over-age entry.

Such are the obvious constituents of 'numbers to be enrolled'. It is no easy matter, however, to estimate from available data what *future* levels of enrolment will be. The task in a developed country with good census and population registration data, and for levels where there is enforced compulsory school attendance, is comparatively straightforward, at least for the short- and medium-term future, for which school entrants may already have been born when the projections are made. But in a developing country with unreliable or incomplete population data, possibly lacking information on the age of existing students, and with attendance at the option of students, it is a far more complex matter involving a whole range of assumptions of doubtful validity.

Methods of projecting enrolment cannot be treated in a short volume such as this, and the interested reader is advised to consult the relevant literature.[1] The two basic points to be grasped from our brief discussion here are first that the best possible projections of enrolment are indispensable for teacher forecasting; but secondly since (particularly in developing countries) the forecasts are unlikely to be wholly reliable, for reasons beyond the planner's control, it is desirable to provide for the greatest possible flexibility in the arrangements for teacher supply.

2. Technology of education and pupil-teacher ratios

The educational technology in use is the key to the output-labour ratio in education (pupil-teacher ratio) and enables one to calculate teacher requirements from pupil enrolments. In the present context

1. See especially Unesco, *Methods of projecting school enrolment in developing countries* (paper no. CSR-E-19 in the series 'Current studies and research in statistics', prepared by the Office of Statistics, Division of Statistics on Education, Unesco). Paris, Unesco, 1976.

'educational technology' does not refer narrowly to equipment, devices and gadgets: rather it embraces the broad areas of curriculum content, pedagogical method and educational organisation.

Curriculum content defines what is to be taught and learned, and the pattern of experiences devised for the child. *Pedagogical method* indicates how teacher-learner interaction is conducted in the different curriculum areas of knowledge and experience—e.g., through lecture, self-study with or without supervision, radio-listening or TV viewing, group/individual tutorial, discussion group with peers, project work, etc. The pedagogical method is closely interrelated with learning materials, equipment, buildings and physical environment and so on, but we are concerned here only with the teacher demand implications of different pedagogical methods.

It is *educational organisation* which effectively converts curriculum content and pedagogical method for a given number of learners into teacher requirements. There are three key components:

1. Average class size, using 'class' to denote a registered group of pupils constituting a recognised permanent sub-unit of the pupil body.
2. Average number of 'teacher contact periods' required by a class over a complete teaching cycle (often, but not invariably, a week of five days divided into between 30 and 50 instructional periods). The weekly input of teacher periods required will exceed the average length of the pupil working week if classes are subdivided for part of the week for practical subject teaching, for small discussion groups or for remedial teaching. Conversely there may be a 'saving' on teachers during self-study periods or at such times as classes are combined for activities such as films, lectures or games. Obviously the number of weekly teacher contact periods required by each class will depend on the curriculum content and pedagogical method in use. It should be noted that class subdivision or combination may well cause the average size of groups actually taught to differ from the registered class size.
3. Average teaching load per teacher, expressed in number of class-contact periods per week. This covers class-contact periods only, not total work periods of teachers (which would include lesson preparation and marking). It is an average load, bearing in mind that teachers with different levels of experience and qualifications, and of different subjects, may have varying loads.

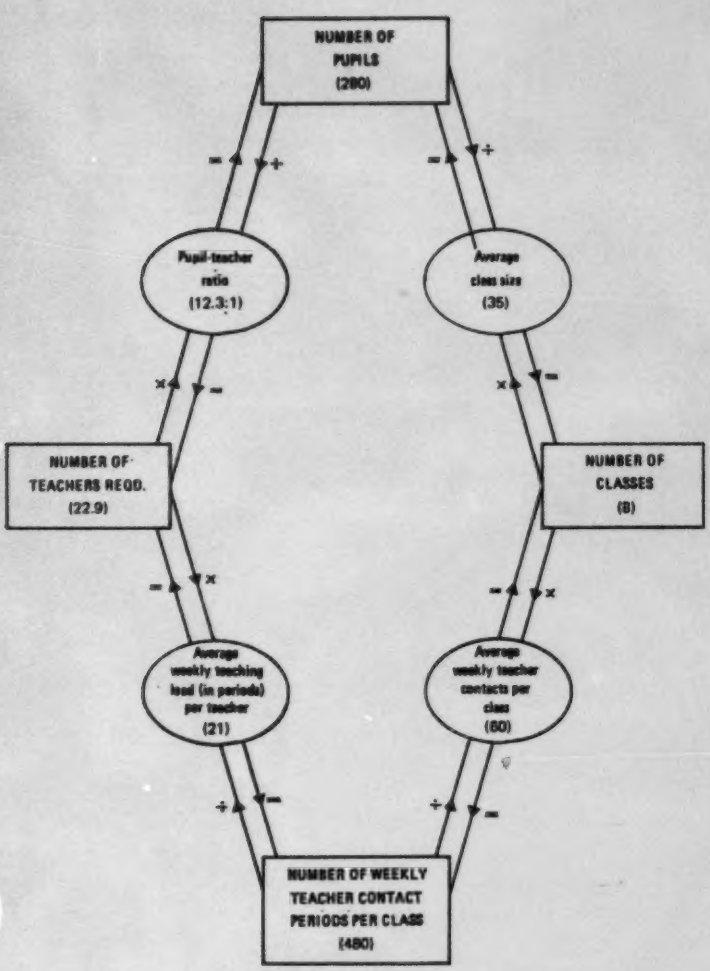
It is at this point, in considering what lies behind the familiar

pupil-teacher ratio, that we find one of the meeting places of the quantitative and qualitative aspects of educational planning, so often claimed to be in conflict with each other. The pupil-teacher ratio is simply a shorthand quantitative expression for something very much more complicated and qualitative; and whilst much the simplest way of calculating teacher requirements is to apply some assumed pupil-teacher ratio to the numbers of pupils to be educated, the educational implications of the assumed pupil-teacher ratios should be understood. Indeed, the pupil-teacher ratio used for teacher requirements forecasting should be based on some 'teaching and learning strategy' which specifies among other things the average size of classes, the total amount of teacher-contact time required by a class over a week, and average teaching loads per teacher per school week.

Figure 1 illustrates the way in which relationships between the numbers of pupils and teachers can be expressed by using the shorthand of pupil-teacher ratio; or in a more complex longhand in terms of average size of classes, class-teacher time per week and teacher loads. The shorthand and longhand versions express the same thing; so that if one arbitrarily changes the pupil-teacher ratio from 35:1 to 40:1, specifying fewer teachers for the same number of pupils, this will have to be translated in the schools into longer hours for teachers, shorter hours for students, or bigger classes (or a combination of all three). Changes in the pupil-teacher ratio are sometimes assumed to affect only the last of these, class size. Indeed class size is popularly often thought to be the same thing as the pupil-teacher ratio; which indeed, particularly in the primary schools of poor countries, it may actually be. The illustrative examples in Table 1 make the difference clearer, however (compare values for s with those for r).

School A in Table 1 represents a typical primary school, in this case having seven classes, each taught as a single group for the whole timetabled week. Teachers are expected to teach every period of the week. The pupil-teacher ratio and the average class size are identical in this case; so the number of classes is the same as the number of teachers.

In *Schools B, C, D* and *E* we change first the average class size *(School B)*, then the number of classes *(School C)*, then the teacher-contact periods per class per week, governing the possibilities of subdividing the class for some periods *(School D)*, and finally the


NUMBER OF PUPILS (280)
Pupil-teacher ratio (12.3:1)
Average class size (35)
NUMBER OF TEACHERS REQD. (22.9)
NUMBER OF CLASSES (8)
Average weekly teaching load (in periods) per teacher (21)
Average weekly teacher contacts per class (60)
NUMBER OF WEEKLY TEACHER CONTACT PERIODS PER CLASS (480)

NOTES 1. Figures in brackets in the boxes are illustrative, and are taken from School F in Table 1.

2. Mathematical signs and directional arrows indicate relationships between neighbouring rectangular boxes (via oval boxes).

FIGURE 1. *Constituent elements in the pupil-teacher ratio.*

Table 1. The pupil-teacher ratio and its constituent elements

	(Longhand calculation of teacher requirements)														(Shorthand calculation)		
School	No. of pupils P		Average class size s		Number of classes C		Av. no. teacher contact periods per week per class k		Total weekly time-tabled teacher contact periods per class x		Average weekly teaching load per teacher (periods) l		No. of teachers required T		Pupil-teacher ratio r		No. of pupils p
A	280	÷	40	=	7	×	35(0)	=	245	÷	35	=	7	×	40		280
B	280	÷	35	=	8	×	35(0)	=	280	÷	35	=	8	×	35		280
C	280	÷	40	=	7	×	45(0)	=	315	÷	35	=	9	×	31.1		280
D	280	÷	40	=	7	×	50(15)	=	350	÷	35	=	10	×	28		280
E	280	÷	40	=	7	×	35(0)	=	245	÷	21	=	11.7	×	24		280
F	280	÷	35	=	8	×	60(15)	=	480	÷	21	=	22.9	×	12.3		280
G	560 { 280 / 280	÷	40	=	7	×	20(0)	=	140 { 280 / 140	÷	40	=	7	×	80		560

NOTE Figures in brackets in column 4 denote the additional number of the teacher-class contact periods per week (also included in the total) necessitated by splitting of classes into smaller teaching groups for part of the school week.
From the above table it can be seen that in order to calculate teacher requirements in quantitative terms the formula to be used is:

either (shortand) $T = \frac{P}{r}$ *or* (longhand) $T = \frac{P}{s} \times \frac{k}{l}$

which may if preferred be re-expressed as $T = C \times \frac{k}{l}$, indicating that total number of teachers required is number of classes (C) multiplied by teacher-class ratio $\left(\frac{k}{2}\right)$.

The values to be assigned to P, s, k, l are policy variables which in combination yield a pupil-teacher ratio.

length of the teacher's week *(School E)*, so as to observe how each of these factors independently will affect the teacher requirement and in consequence the pupil-teacher ratio. *School F* illustrates the effect of changing all these four variables simultaneously.

In *School B* the average class size has been lowered, to provide that the 280 pupils are divided into eight classes of 35, thus requiring the provision of one extra teacher.

In *School C* the class size reverts to 40, but the length of the school week is increased from 35 periods to 45. Since the individual teacher load is only seven-ninths of this (35 class contact periods per week), the seven classes now require a total of nine teachers.

In *School D* an extra 15 teacher-contact periods are given to each class, making possible the splitting of classes for sessions in smaller groups for 15 out of the 35 periods in the week. Expressing this in another way, one could say that the teacher allocation per class is increased by 43 per cent, from one teacher per class to 1.43 teachers per class; this makes it possible for pupils to be given instruction in smaller-sized groups or on an individual basis. As an illustration of the variety of teaching methods and styles that could result from the provision of ten teachers for seven standard-sized classes, one could imagine that the first three periods of the school week might be organised as follows:

1. 4 groups of 40 (standard classes) = 160
   plus
   6 groups of 20 (half classes) = 120
   i.e.,
   280 pupils in 10 groups with 10 teachers
2. 1 group of 120 (3 standard classes watching film, supervised by two teachers = 120
   plus
   8 groups of 20 (half classes) = 160
   i.e.,
   280 pupils in 9 groups with 10 teachers
3. 7 groups of 40, less 9 pupils withdrawn for remedial work = 271
   plus
   3 groups of 3 pupils withdrawn on rotating basis for remedial work with 1 teacher per group = 9
   i.e.,
   280 pupils in 9 groups with 10 teachers

Of course, most school systems cannot afford such a generous provision of teachers, and the above examples are illustrative only. But the provision of even an extra 10 or 15 per cent of teacher time to each class can make possible a great deal of variation in teaching mode and size of the learning group.

In *School E* the difference from *School A* is that the average teacher load has dropped to 21 periods, teachers spending on average 14 periods out of the 35-period week not in front of a class. These 'non-teaching' periods may be used for administrative work, marking and preparing, and so on. Note that it is the *average* teacher load that has dropped compared with *School A*—it may be that two or three members of the school staff have mainly administrative duties and teach less than five periods per week, leaving the remaining teachers to bear a heavier load.

In *School F* simultaneous changes are made in class size, length of the school week, number of teacher contact periods per class and teacher loads, each variable being altered in the direction which requires additional teacher provision. The combined effect of all four changes is to more than triple the teacher requirement in *School F* compared with *School A*, and the pupil-teacher ratio falls proportionately from 40:1 to only 12.3:1.

School G represents a rather different situation from any of the others—the double-shift school. Here, instead of having a new set of teachers for the afternoon shift (which would effectively amount to the creation of *two* schools in the same buildings), the pupils have 'short-time' schooling and the teachers take both morning and afternoon shortened sessions. The size of the teaching groups is no different from *School A*, but the pupil-teacher ratio has soared to 80.

The foregoing discussion suggests that the pupil-teacher ratio finally arrived at is the product of choices in different areas of school and curriculum organisation. Two important limitations to the planner's freedom of choice should, however, be noted. First, it may well be that the size and number of existing classrooms in schools preclude either large classes on the one hand or sub-division of classes on the other. This problem may of course be overcome in new schools by flexible building design. Second, in rural areas there may be constraints imposed on possible class size by the facts of population distribution. Although a standard primary class size of 40 may be specified in the school regulations, there will be villages

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where only 5 or 10 seven-year-old children present themselves for grade 1 of school each year. To some extent, one may be able to achieve an economically more viable teaching group by combining consecutive grades under one teacher, or by forming one-teacher schools. Rich countries may be able to afford bussing, or boarding schools, in order to build up classes to a viable size. But it is a fact of life, for which the educational planner must be prepared, that actually achieved average pupil-teacher ratios in countries with large and scattered rural populations will almost always be below the norm.[1]

This concludes our discussion of the required size of the *stock* of teachers overall. Later, in Chapter VI, we will consider demand for teachers of different subjects and in different regions. It is hoped that the reader has been able to identify the many points at which choices have to be made with regard to the two main determinants of teacher demand; namely, the number of pupils to be educated and the technology of education to be adopted. Certainly choice will be inhibited by scarcity of financial resources, but one must still choose within the resources available between expenditure on education and expenditure on other goods and services, and within education between different technologies. This is why we speak in this volume of 'planning teacher demand' as well as of 'planning teacher supply'.

The required flow of teachers

So far teacher demand has been considered from a static point of view in terms of the determinants of the size of the teaching force at any given moment. Our discussion must now switch to a dynamic perspective and consider the flow of teachers over time. In other words it is necessary to examine the factors determining the rate at which teachers should be recruited. There are three main factors of change to be taken into account:

1. Growth or decline of the total teacher stock, reflecting change in the size and composition of the school population and/or change

1. The problems of forming viable-sized teaching groups are further discussed in Jacques Hallak's recent study *Planning the location of schools: an instrument of educational policy* (Paris, Unesco: IIEP, 1977).

in policies affecting the scale of provision of teachers for any given number of pupils. We may call this element 'development' demand for teachers.

2. Planned change in the nature and composition of the teacher stock itself, for example the deliberate phased replacement of particular categories such as poorly qualified teachers or of expatriates. This might be termed 'special replacement' demand.
3. Change in the individual composition of the teacher force due to regular causes of attrition such as death, retirement, resignation, etc. This element might be designated 'normal replacement' demand.

1. Development demand

Changes in the size of the teaching force, arising from growth or decline in enrolments or from changes in the way teachers are used in the education system, constitute development demand. Such changes may normally be expected to result in increased demand for teachers, because of population growth and higher participation rates in education, and because countries as they develop hope to improve staffing ratios. But there is of course no inherent reason why the changes should be in that direction. Quite a number of countries now foresee a smaller teaching force in future, for either demographic or financial reasons.

Growth or decline in the numbers to be taught, as was noted on page 40, would be the outcome of changes in one or more of three main variables, as follows. (1) The lengthening or shortening of school courses, or a change in the entry or leaving age, will directly affect enrolments. (2) The growth or decline of the numbers in the age group is likely to be still more important. In many developing countries it is necessary to produce enough extra teachers each year to cater for an additional 3 or 4 per cent more children just to maintain the same enrolment ratio as at present. In other areas of the world, such as parts of Western Europe and the United States, on the other hand, the annual number of births has dropped by a quarter or more in the past ten years. (3) Rising or falling enrolment ratios are the third major determinant of changes in the numbers to be educated. If, for example, a programme of universal primary education is to be announced, ten new universities are to be built, or fee levels are to be reduced, enrolment ratios will rise and the consequences for teacher demand will be profound.

Changes in educational practice, affecting future pupil-teacher ratios, will be the other determinant of 'development demand'. Such changes may arise from professional conviction about the educational efficacy of some innovation, such as the introduction of new subjects to the curriculum, or of new ways of using teachers. For example, a decision to introduce more practical subjects would probably require smaller learning groups, as would additional remedial classes for slower learners, and a higher teacher requirement would result. Conversely, it has sometimes been claimed (though not yet conclusively shown to most people's satisfaction) for the mass media, that they can potentially be substituted for teachers: if this were so, a decision to introduce 'schooling by TV' might reduce the number of teachers needed.

On the other hand, changes in the pupil-teacher ratio may sometimes simply reflect availability or shortage of money rather than professional judgments. There is in any case a constant tension between the educators and economists over whether 'improving the pupil-teacher ratio' is to be interpreted in an educational sense as meaning *fewer* pupils per teacher, or in a cost-reducing sense meaning *more* pupils per teacher (less teacher cost per pupil). If the claims of some researchers that learning achievement is not adversely affected by larger learning groups were validated, the financial advantages of higher pupil-teacher ratios might well carry decisive weight with the policy-makers.

2. Special replacement demand

These programmes, arising from the deliberate intentions of the managers of the system, generally aim at replacement of foreign teachers by nationals of the country or of professionally untrained or unqualified teachers by qualified ones. This presupposes that those to be replaced are on temporary terms and can in fact be asked to leave, on being given due notice of termination of their services. In a few instances it may be found that expatriate or unqualified teachers in fact have permanent and pensionable appointments, and that the replacement programme cannot apply to them all. For unqualified teachers 'replacement' may mean not summary dismissal, but being given the opportunity to enter teacher-training colleges; or they may be offered part-time in-service courses by correspondence, radio, etc., to upgrade themselves to qualified status while teaching. In some countries this process of gradual 'internal

promotion' of unqualified teachers to qualified status is a recognised feature of the system. It necessitates rather careful accounting of teacher flows, since such teachers may change status without ever leaving the teaching service.

In drawing up the replacement programme the crucial question to be decided is the length of the period over which replacement is to take place; this determines the required annual flow of new teachers for this purpose. The 'change of gear' involved in starting and completing replacement programmes can dislocate teacher supply facilities unless carefully phased. A gradual phasing in and out of replacement will obviously put less strain on the system than an abrupt start and finish.

A final point to note on replacement programmes is that the desirability of complete replacement of temporary categories of teacher is not wholly self-evident. Quite apart from the possibility that they may be cheaper to employ, temporary teachers are also often more willing to serve in difficult posts. To keep a pool of temporary appointments in a teaching force (even if the individual incumbents of those temporary posts change) can provide a much needed flexibility in responding to changes in demand arising from unpredictable trends such as population shifts. There is much to be said for planning a teacher force with only 85-95 per cent permanent and pensionable employees, rather than aiming for the full 100 per cent.

3. Normal replacement demand

The stock of teachers is liable to 'natural wastage'. Even when there is no development demand and no special replacement programme, it will still be necessary to recruit new teachers to maintain and renew the stock. Otherwise death, retirement, resignation and illness will take their toll and the number of teachers will decline. Teacher wastage is discussed in more detail in the next chapter under the supply of teachers.

Indeed, we cannot take the discussion of demand further at this point without first investigating supply, since the requirement of new teachers derives from the gap between 'stock required' and 'stock available' at some future date. We shall therefore return to discussion of demand in relation to supply in Chapter VII.

Meanwhile this section can be summarised by listing again the elements that go into teacher demand. It is useful for policy pur-

poses if calculations of teacher demand can specify separately these components of total demand:

Development demand

- — changes due to enrolment growth/decline resulting from
  - — structural change
  - — population change
  - — change in enrolment ratios
- — changes in pupil-teacher ratio resulting from
  - — class size change
  - — length of school week change
  - — teacher periods per class change
  - — teacher loads change

Special replacement demand

- — unqualified, underqualified
- — expatriates
- — others

Normal replacement demand

- — death
- — retirement
- — resignation, etc.

} as further discussed in Chapter IV.

IV. The supply of teachers

The supply of teachers should be considered under the same two heads as demand, namely stocks and flows. The stock of teachers is another name for the teacher force: teacher flows include both outflows (wastage from various causes) and inflows (new recruitment, re-entry).

The stock of teachers (teacher force)

Basically the supply of teachers at any moment in time consists of the teachers serving in the schools, plus those who are on the payroll but on temporary release for in-service training or approved leave. The total supply of teachers does not necessarily equal the demand, for schools and colleges may be short-staffed and have vacancies. Alternatively, there may be oversupply, with educational institutions staffed above their norms; the fact that teachers are employed does not necessarily prove a manpower 'need'. It was also noted in the discussion of replacement programmes in Chapter III that the composition of the teaching force may sometimes be regarded as unsatisfactory, so that although supply may quantitatively equal demand in terms of overall numbers, it may be considered unsatisfactory in qualitative terms. This is the case when many unqualified teachers are in service, or when particular areas of the curriculum such as mathematics either have to be dropped through lack of teachers, or are being taught by wholly inadequate staff.

It is essential for sound planning that the educational authorities have at their disposal full information about the size and charac-

teristics of the existing teaching force and its distribution between different types of school. This is so for several reasons. In the first place it makes possible a comparison with demand and allows the adequacy of existing supply, and the efficiency with which it is used and distributed, to be assessed. Second, to the extent that the teaching force in fact consists of several sub-populations each with characteristics of its own, future supply—both overall and in sub-categories—can only be projected at all accurately if calculations are made on a disaggregated basis. Third, the annual budget projections and sound financial planning depend on accurate information about the teacher stock. All this may seem obvious, but it is nevertheless surprising how poor the state of teachers' records and of statistical data about the teaching force is in a great many countries.

The two main sources of information on the teacher force are the annual (or more frequent) statistical returns from the schools and the personnel records kept on individual teachers. The latter should contain data for each teacher on age, sex, educational background and professional qualifications, current status and seniority, record of teaching experience and posts held, language (where relevant in a multilingual system) and salary. So long as this data is kept regularly up to date it can provide both a picture of the current stock of teachers and information on the loss and transfer of teachers, as well as their re-entry. If the records are held on a computer such information should be readily accessible. In many countries, however, the system of teacher records is not yet sufficiently efficient to rely mainly on them for data about the teacher force, and the school statistical returns are used. The disadvantage of these is that they are less detailed; they probably omit data on teachers temporarily absent from the classroom; and they cannot be used to trace the destination of teachers who move from a school between census dates even though they may record their departure. Consequently they yield aggregate data from which only rather crude estimates of the magnitude of teacher flows can be made. On the other hand, the school census is a useful source of information on the way in which teachers are being used in schools, their teaching loads and the subjects and levels they are teaching.

Of particular significance are the data on age and qualification, making possible the construction of age-qualification profiles of the teaching force. The preparation of successive annual profiles can

provide vital information on the numbers reaching and likely to reach retirement age, on potential promotion blocks resulting from unevenness in past intakes of the teaching force, and on the steady improvement (if such there be) of teacher qualifications.

Teacher flows

1. Outflows

The bulk of teacher supply in any year consists of teachers retained in service from the previous year. The teaching force is like a large orchard, which has been planted over many years and yields its return over a long period. It takes many years to mature and cannot be replaced quickly. New varieties are continually being planted but the great bulk of production is from mature trees and it is only over a decade or more that the new varieties come to account for the major part of the fruit crop.

But, like an orchard, the teacher stock is subject to deterioration and loss. Teachers die, 'wear out' and fall sick, grow older and have to retire. They also, like trees, become unproductive and if personnel inventories could record the effectiveness of teachers it would be found that the majority of teachers were in need of 'reconditioning' through in-service courses or retraining, just as an orchard requires spraying, fertiliser or tree surgery. Teachers may also—and here the analogy of the orchard no longer holds good—resign.

The teaching force is, then, a wasting asset, subject to constant depletion of a number of distinct kinds. The most obvious are:

1. *Death.* In the case of a rapidly expanding teacher force with a preponderance of young and recently qualified teachers this will not be a major cause of loss; especially as teachers tend to belong to groups of higher socio-economic status, with a higher life expectancy, than the average.
2. *Retirement.* The rate of retirement will depend on the profile of the teaching force. In a completely stable teaching force, with no other source of wastage, the numbers reaching retirement age would of course equal new annual intake. But in systems that have recently been expanding fast, the average age of teachers is much nearer entry age than retirement age; and instead of retirement running at say 3 per cent (implying 100 per cent turnover over an average career span of 33 years) we may find it

running at only 0.5 or 1 per cent. Clearly a short working life, resulting from a late age of graduation from teacher training and an early retirement age, will, other things being equal, produce a higher proportion of annual retirements relative to the size of the teaching force than if graduation is early and retirement late.

3. *Resignation.* This cause of wastage is the one that perhaps attracts most attention, since it is closely bound up with the issue of the attractiveness of teachers' terms and conditions of service relative to alternative livelihoods. Whilst the 'alternative' may normally be another salaried job, it may also involve return to the home village to run a family business or farm, or in some cultures may just as likely be the possibility of reversion by married women to the life of full-time housewife and mother. In Ontario, Canada, for example, between 1965 and 1970 about 35 per cent of all withdrawals from the elementary teacher force each year consisted of 'married women retiring to household'.[1]

In considering the relative attractiveness of teaching and other jobs, the factors that a teacher is likely to take into account include (i) *conditions of service:* these include pay, allowances, pension entitlement, housing arrangements, hours of work, etc., and are undoubtedly the most important consideration for most teachers; (ii) *promotion prospects:* it is unfortunately true that even when starting rates of pay for teachers have become competitive with those for other occupations, the ratio of senior to junior posts (of 'generals' to 'privates') tends in many countries to be unfavourable. In highly centralised countries the teaching service, which may be as big as the rest of the public service put together, often has one chief professional post only, whilst twenty other smaller professions may also have one each. As important as the promotion structure of the profession are the practical possibilities for teachers to earn promotion through improving their qualifications and professional competence; (iii) *professional support:* teaching can be a lonely and isolated job where morale depends very much on the success of the professional leadership in making teachers in the field feel they are doing a job that is

1. Watson, Cicely; Quazi, Saeed and Jones, Russ, *The elementary teacher: a study of the characteristics and supply/demand relations of Ontario teachers.* Ontario, Department of Educational Planning of the Ontario Institute for Studies in Education, 1972.

appreciated, and in giving them opportunities for professional contacts and professional refreshment; and (iv) *personnel administration:* the sense of fairness and efficiency, particularly over the matter of postings, appointments and promotions, is vital.

4. Dismissal in the case of misconduct; the numbers affected are usually very small.
5. *Temporary withdrawals.* These include secondments and approved absence for in-service training, study leave, military or national service, etc.
6. *Redesignation within education.* This would cover those who are promoted from teaching to supervisory posts of various kinds in education. The persons concerned may thus be lost to teaching but not to the education service as a whole.

In looking at the complete teaching force it has not been necessary to take account of transfers between segments of the education system, since transfers do not represent loss to the entire stock of teachers. But if one is looking at a sub-section of the system—Grade B teachers in primary schools in the Southern Region, for example—loss to that particular sub-population of teachers will include transfers out to private schools, to nursery and secondary schools, to the Northern and Eastern Regions, upgrading to Grade A status, and so on.

In a similar way one must distinguish between teacher *turnover* and teacher *wastage*. Turnover refers to the annual rate of teachers leaving their particular school post. Thus turnover would include not only wastage, but also the lateral movement of teachers between identical posts in different schools. This is extremely important from the point of view of stability of school staffing and the sense of permanence that a school community may have. From the point of view of the learners, the reduction of turnover, with all the distressing discontinuities it implies, is a matter of priority. But it is a phenomenon distinct from wastage, loss or attrition; even though it may have some similar causal roots.

It is impossible to generalise about levels of retention and wastage in the education systems of the world. The amount of wastage obviously varies very much according to the economic climate, being lower when alternative jobs are scarce. In countries with severe manpower shortages, alternative opportunities for teachers may be good and resignation rates will be heavier, unless checked by bonding arrangements. Clearly the age and sex structure of the

teaching force affects the level of wastage quite considerably. Another influential factor is the level of general education of the teacher, with university graduates for example having many more attractive employment opportunities and so being much more mobile than certificate-trained middle-school leavers.

The estimation of future teacher wastage rates is one of the most problematical areas in teacher forecasting even where—and this condition does not apply in all countries—good data exist on the size and causes of wastage in the past. Particularly difficult to forecast are the numbers likely to resign to take up other occupations, for this largely reflects relative conditions of service in teaching and other occupations. Similarly unpredictable future changes in the birth rate will not only affect the number of children to be taught, but will also in the short term have their impact on numbers of women withdrawing from teaching for maternity reasons.

2. Inflows

It is just possible to conceive of an education system which was running down at such a pace that the existing teacher stock, continuing from year to year on a depleted basis, constituted a sufficient supply to meet diminishing demand. In that case no new recruitment would be necessary. There are many examples of individual educational institutions which have been allowed to 'die' in this way by being forbidden to take on new staff; but probably no complete educational system has operated on such a basis for more than a year or two at a time. Even where the size of the system and of the teaching force is contracting, the annual fall in the required stock of teachers would normally be less than annual teacher wastage; so that some new recruitment would still be necessary. And most education systems are not in such a state of contraction; they are experiencing a strong development demand for teachers, stemming from their plans for both expansion and improvement. This, together with replacement needs, gives rise to a large requirement of new recruits.

The main sources of annual new recruitment of teachers are:

1. Those returning to the classroom from secondment, leave or in-service training (category 5 wastage on page 56).
2. The teacher-training system (initial training).
3. Recruitment from the domestic labour market of
   (a) former qualified teachers who have left the service at some

time past (category 3 and possibly even category 2 wastage on pages 54-55), and

(b) those who have never been qualified teachers.

4. National service arrangements.
5. Foreign labour market (sometimes through development assistance agencies).

The first three of these sources (1, 2 and 3a) produce long-term fully qualified recruits who are likely to be offered permanent appointments. It is probable that the last three sources (3b, 4 and 5) will yield recruits on a temporary basis.

1. *Returners.* It is possible to argue that returners are not new recruits at all, since they may have been on the payroll, or have at least been regarded as full members of the teaching service, during their period of absence. They are 'returners' to the classroom or school, not to the teaching service as a whole. Whilst the number of returners may be balanced by new releases, this does not necessarily follow. If a large programme of further training or retraining of teachers is coming to an end, the number of returners could exceed new releases by a wide margin.

2. *Initial training.* This is normally thought of as the main source of supply to the teaching force. The traditional pattern of teacher training has comprised full-time courses of from one to five years, starting immediately after completion of general education. In some countries new patterns and structures of initial training are now being experimented with, and these include arrangements for aspirant teachers to have a period of service in the schools before admission to full-time teacher-training institutions, or sometimes during their course, or for some of the training period to consist of supervised induction on the job. As already noted in the discussion of special replacement programmes in Chapter III, it should also be recognised that in many countries the in-service training of unqualified teachers provides an internal promotion route to qualified teacher status. For the purpose of what follows, however, it is assumed that initial teacher training takes the form of continuous full-time pre-service courses.

The annual flow of newly qualified teachers from the teacher-training system to the schools will depend basically on the capacity of the teacher-training institutions as reckoned by numbers of student places and the rate at which students pass through these

places, as indicated by the average length of course for students (output = capacity/average no. yrs. per student).

Table 2 illustrates how, for a given capacity of a teacher-training college or teacher-training system, output will be higher if courses are shorter. An institution with only 3-year courses and 360 places can turn out 120 teachers per year (A). The same number of places for a 2-year course will produce 180 teachers annually (B). If two-thirds of the places are given to 3-year courses and one-third to 2-year courses, the potential output will be 140 teachers (C). By reversing the proportions on the two courses, one obtains a rise in

Table 2. Effect of variation of length of course on level of output in teacher training.

College	Length of courses	Enrolments			Total enrolment	Annual output (= final yr. enrolment)
		1st year	2nd year	3rd year		
A	3-year	120	120	120	360	120
B	2-year	180	180	—	360	180
C	3-year	80	80	80	240 ⎫ 360	80 ⎫ 140
	2-year	60	60	—	120 ⎭	60 ⎭
D	3-year	60	60	60	180 ⎫ 360	60 ⎫ 150
	2-year	90	90	—	180 ⎭	90 ⎭

Table 3. Calculation of average length of course per student (based on Table 2).

College	Total student-years to be spent in college by presently enrolled students			Total number of students	Average length of course per student (years)
A	360×3	$= 1\,080$	$\div$	360	3.0
B	360×2	$= 720$	$\div$	360	2.0
C	$240 \times 3 = 720$ ⎫ $120 \times 2 = 240$ ⎭	$= 960$	$\div$	360	2.67
D	$180 \times 3 = 540$ ⎫ $180 \times 2 = 360$ ⎭	$= 900$	$\div$	360	2.5

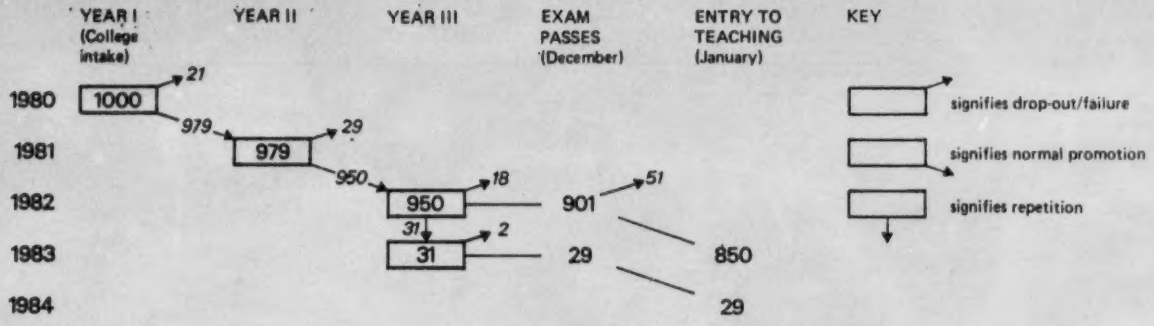
£0

output to 150 (D). In other words, output is inversely related to average length of course per student.

The model of teacher-training enrolment shown in Table 2 assumes no wastage in the teacher-training system. In fact, however, there may be wastage of a number of kinds. First, the places provided may not be fully utilized because of unwillingness by potential students to enter teaching. In this case it is normally the image of the teaching profession itself that is mainly at fault, but recruitment to teacher-training courses can be encouraged by provision of scholarships, and by generous training allowances etc. during college courses. Second, just as the teacher stock itself is liable to attrition, so are cohorts of teacher trainees. At least four types of wastage among enrolled trainees may be encountered and must be allowed for in teacher supply estimates. These are: 1. Drop-out from the course (output loss); 2. Grade repetition (output delay); 3. Failure on final examinations (output loss); and, 4. Failure to enter teaching (output loss).

A more realistic model therefore might look more like the one shown in Figure 2. From this it seems that from 1,000 teachers admitted in 1980, there will emerge only 850 in 1983 (plus another 29 via repeating and re-sitting of the examination in 1984). This represents a loss of 15 per cent (13 per cent if account is taken of successful repeaters). If the objective is to have 1,000 new teachers (of 1980 vintage) entering service in 1983, then in planning ahead allowance must be made for this loss, at 15 per cent or whatever rate is considered to be more reasonable (were special factors at work encouraging loss in the period 1980-83?). In fact, mathematical calculations show that the intake in 1980 will have to be 1,176 if 1,000 teachers out of the intake are to enter schools in 1983 and if cumulative wastage factors are assumed to operate at a 15 per cent rate (85 per cent $\times$ 1,176 = 1,000).

The fate of failures on the final course examination may have quite an important impact on the level of teacher supply. Practice varies from country to country on this. Some countries allow teachers to repeat in college (as shown in Figure 2). Others allow them to re-sit the examination in a private capacity at a later date. Yet others allow them to enter the teaching force and re-sit the examination at the end of a year's teaching. This last course has been the practice in Ghana, for example, where the teacher-training college examination results have been available only after the start



NOTES

1. The above illustration assumes no repetition in the first and second years of the course.

2. In this example out of 1,000 initial entrants to college . . . . .

50 drop out in Years I and II

20 fail the examination on first (18) or second (2) attempt

51 pass the examination on first attempt but fail to enter teaching

29 pass the examination after repeating and enter teaching

850 complete course successfully in assigned time and enter teaching

1000

FIGURE 2. *Illustration of cohart progression in initial teacher training.*

of the next academic year: hence the appearance in the Ghana education statistics of a category of teachers labelled as 'awaiting results', and hence also the need to find room in the Ghanaian teaching force for all college completers, some of whom in the event prove not to have passed their examination.

3a. *Re-entry of qualified teachers.* There may be some re-entry to the profession, particularly at times of teacher shortage, of those who have resigned or retired. In some cultures it is not unusual for women to resign in order to devote themselves full-time to looking after their young children. This is particularly common in societies where communal living arrangements are such that relatives and friends are not normally available to help with child-minding, or where a network of crèches and nurseries has not been developed. As the children grow up and enter school many mothers may re-apply to resume work full-time or part-time, after an interval of perhaps ten years from resigning. This phenomenon is negligible in many countries of the world, where women may not be inclined to withdraw from teaching when they start their family. But its potential significance in others is illustrated by the British case. The Department of Education and Science in Britain foresees the possibility that in the early 1980s re-entrants might account for 10,000-15,000 and new entrants for 20,000 of the annual recruitment of 30,000-35,000 needed to sustain the teaching force in England and Wales.

3b. *Recruitment of unqualified personnel.* This solution is likely to be employed on any great scale only at times of extreme supply shortage. Many developing countries have taken on educated but untrained personnel to man the expansion of their primary and secondary school systems. It is normally regarded as a makeshift arrangement but has the advantage of cheapness and speed, since unqualified teachers receive modest reward and are employed as soon as recruited. Often, too, countries find themselves obliged to drop their insistence on professional qualifications in the case of scarce subject teachers such as those of mathematics, science and practical subjects. More interest is now being taken in the use of non-professional teachers, usually on a part-time basis, for help in making the curriculum more practical and relevant. Thus some governments are encouraging the idea that extension officers from agriculture and health should give instruction in the schools, and local craftsmen are being used for teaching of practical subjects.

The participation of community leaders and others in cultural and moral instruction is also being welcomed in some countries.

4. *National service arrangements.* In situations of great teacher shortage a number of countries have imposed an obligation on more educated young people to teach, as part of their service obligations to the nation. This has the advantage of mobilising large numbers quickly, without the necessity to raise teacher remuneration to perhaps unaffordable levels in order to induce people to serve as teachers. A service obligation falling on all in a certain category may also be regarded as more equitable than selective forms of manpower allocation. Examples of servicemen being used in education include the Iranian Educational Corps, the Nigerian National Youth Service Corps, and the proposed new national service scheme in Botswana.[1] A rather different scheme was the obligation imposed under the Ethiopian University Service Scheme whereby students at the University in Addis Ababa spent the fourth year of their course in a form of community service, often teaching in the rural areas. Between 1964 and 1974 this Scheme contributed 2,771 teachers to Ethiopia's secondary schools.[2]

5. *Foreign labour market.* In some countries at certain historical periods a large part of teacher supply has consisted of non-nationals. This was true of the beginnings of formal schools in many Asian and African countries which were frequently started by foreign missionaries; and in the later post-independence era the secondary-school systems of many African countries in particular were heavily supported by expatriate teachers serving under bilateral and multilateral assistance schemes and volunteer programmes. Currently one of the largest flows of foreign teachers is to the Arab countries of the Gulf area from Egypt and other Mediterranean Arab countries. Significant numbers of Indian and Pakistani teachers are serving outside their home countries at secondary and tertiary levels. The disadvantages of using foreign teachers, from a linguistic, cultural and even possibly from a social and political point of view, are well known; and they may bring with them the particular dis-

1. Many of these schemes are described in Fussell, D., and Quarmby, A., *Study-service: a survey.* Ottawa, International Development Research Centre, 1974.
2. Habte, Aklilu, 'The public service role of the University: the Ethiopian University Service—a service-study experiment', in *Higher education for development in Africa: African regional report.* New York, N.Y., International Council for Educational Development, 1975.

advantage of discontinuity. However, as a stop-gap enabling countries to buy time while they develop their own sources of teacher supply, there is obviously much to commend their use, if this is wisely planned. The seriousness of many of the problems of phasing (discussed on pp. 15-21) can be mitigated if overseas teachers are used as a temporary makeweight. The devotion many of these expatriates have brought to their task, and the cultural enrichment they may have introduced, have been valuable assets to many countries.

V. Balancing teacher supply and demand

The review in the last two chapters of factors determining demand for and supply of teachers leads on to consideration of adjustment between the two.

Static and dynamic equilibrium

In trying to achieve balance, the planner will strive to ensure not just a balance at one particular period of time in the future, or in other words a static equilibrium, but also the best possible continuing or dynamic equilibrium between supply and demand over successive years. Achievement of dynamic balance creates few problems when the size of the teaching force is projected to change (in most circumstances to grow) at a steady rate, with a more or less constant rate of annual teacher wastage. It is much more problematical, however, when growth of enrolment is not expected to be steady, or when there is a special replacement programme which will be completed by a particular date.

To take the first case, of irregular trends in development demand for teachers, one can think of several sets of circumstances in which such irregular growth might occur. For example, policy decisions to introduce universal primary education, to increase the enrolment ratio in secondary education, to add a grade to one of the stages of the system, or to raise the school leaving age, might all have the effect of unleashing a considerable extra demand for teachers in a particular school year, thus creating a discontinuity in the trend of annual requirements for teachers. A rather sudden acceleration of output might have to be planned.

Conversely there are circumstances in which the opposite requirement might make itself felt, with a need to scale down the rate of teacher output. A comparatively common experience in some of the more developed countries has been a marked fall in the birth rate in the 1960s and 1970s, following a previous rather strong rise. Thus after a period of substantial enrolment growth, a phase of decline is now setting in; and the forecasts of teacher requirements have had to be revised abruptly downwards, with painful consequences in terms of teachers without immediate jobs and teacher-training facilities no longer needed. Given rather long lead-times for the planning of new teacher-training institutions, it has not been unknown for facilities to be declared redundant almost as soon as they have been opened.

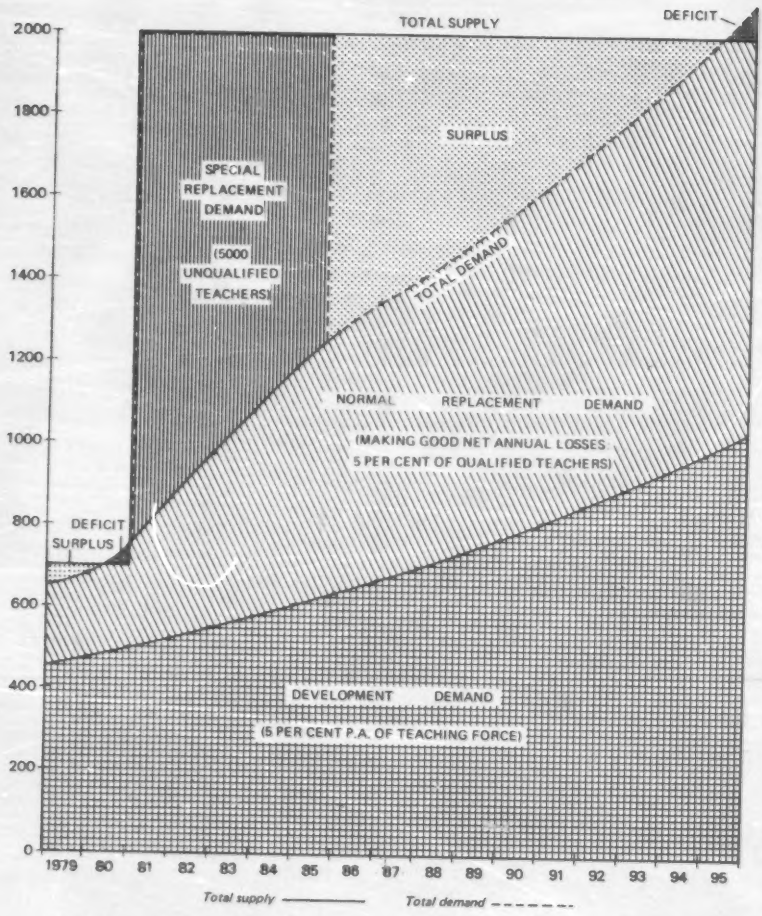
The second case, of special replacement programmes of limited size and duration, has been more common in developing countries, many of which have relied on temporary recruits—both unqualified teachers and expatriates—to staff the rapid expansion of enrolment. As the shortage has eased and plans to raise domestic trained teacher output have materialized, it has been possible to set target dates for replacement of temporary teachers. In such cases the short-term rate of flow to make good the deficit (including replacement of temporary staff) by a certain date will often be higher than the longer-term equilibrium rate of flow required to service steady growth plus attrition requirements. To use an analogy, if I want to escort my friend's car along the road at a speed of 60 km. per hour, but he is already 1 km. ahead of me, I should need to travel for three minutes at 80 km. per hour before dropping my speed down to his. Without deceleration, my car either crashes into my friend's or rapidly overtakes it. In the teacher field the equivalent effect of maintaining the rate of teacher output needed to close the gap, even after the gap is in fact closed, is that one produces teachers surplus to requirements. But whilst sudden deceleration is not difficult in a car, in manpower production it involves reducing the rate of output, possibly by closing training institutions, and this is no light undertaking when people's careers and large investments are at stake. Table 4 and Figure 3 illustrate a hypothetical situation of this kind where, in the face of trained teacher shortage, the capacity of the teacher-training system has been built up rather rapidly in order to eliminate untrained teachers within five years. Given current projections of demand, recruitment of teachers at

	Stock of teachers in service			Allocation of 2 000 newly trained teachers at end year			
	1	2	3	4	5	6	7
Year	Total supply	Qualified supply	Deficit of qualified teachers (filled by unqualified)	Growth in demand[1] (5% col. 1)	Net wastage of qualified teachers[2] (5% col. 2)	Replacement of unqualified[3]	Annual surplus
1980	10 000	5 000	−5 000	500	250	1 250	—
1981	10 500	6 750	−3 750	525	338	1 137	—
1982	11 025	8 412	−2 613	551	421	1 028	—
1983	11 576	9 991	−1 585	579	500	921	—
1984	12 155	11 491	−664	608	575	664	153
1985	12 763	12 763	—	638	638	—	724
1986	13 401	13 401	—	670	670	—	660
1987	14 071	14 071	—	704	704	—	592
1988	14 775	14 775	—	738	738	—	524
1989	15 513	15 513	—	776	776	—	448
1990	16 289	16 289	—	814	814	—	372
1991	17 103	17 103	—	855	855	—	290
1992	17 959	17 959	—	898	898	—	204
1993	18 856	18 856	—	943	943	—	114
1994	19 799	19 799	—	990	990	—	20
1995	20 789	20 789	—	(1 039)	(1 039)	—	(−78)
			Sub-totals	10 789	10 110	5 000	4 101
			Total	30 000			

1. 'Development demand'
2. 'Normal replacement demand'
3. 'Special replacement demand'

} see classification of demand categories in Chapter III.

NOTE Assumptions in the above Table:
(a) Constant pupil-teacher ratio. Therefore teacher supply growth reflects enrolment growth (5 per cent per annum) and surplus of qualified teachers from 1984 onwards cannot be employed.
(b) Net wastage of qualified teachers 5 per cent per annum.
(c) Output of new teachers constant at 2 000 per annum.



NOTE For illustrative purposes an extreme case of a 'crash' replacement programme over a five year period has been taken, with teacher supply raised from 700 p.a. to 2,000 p.a. in a single year. A much smoother fit between the demand and supply curves could have been achieved by expansion of supply to say 1,600 p.a. with a longer replacement period.

FIGURE 3. *Problems of keeping teacher supply and demand in balance in face of replacement programmes (graphical representation of data in Table 4).*

present levels will be excessive over a ten-year period after the untrained teachers are eliminated. A better balance would have been struck by expanding teacher supply capacity more gradually and allowing a longer period for the replacement of the untrained.

In recognizing the necessity in certain circumstances of reducing the level of teacher output, some particularly difficult problems arise from the fact of long lead- and lag-times in the supply of trained teachers. Thus it may well be necessary to start shutting down teacher-training capacity when there are still visible shortages of teachers in the schools. This kind of decision is difficult to explain to the public, and helps to explain why the policy decision to reduce teacher output has sometimes been unduly deferred.

Uncertainty and the need for flexibility

In the examples and illustrations given in the previous section, it might be thought that with careful foresight and skilful programming a continuing balance between supply and demand might have been achieved and maintained. After all, major changes inducing significant increases in the demand for education, or the timing of replacement of unqualified teachers, should be under the control of the policy-maker. Even a shift in fertility trends, whilst not amenable to his direct control or influence, does afford considerable advance warning before extra or fewer babies grow up to become more or fewer school pupils requiring additional teachers.

True as all this is, and whilst there have been many examples of teacher supply/demand imbalance due to faulty planning, it is by no means possible for even the most skilful planner to predict each and every eventuality affecting teacher demand. There are too many major occurrences and trends outside the control of governments themselves, let alone the educational planners. Who could foresee major natural disasters, the failure of the main export crop, the tripling of oil prices, or the closure of the Suez Canal? Events of this magnitude may seriously weaken the capacity of a government to sustain economic and educational expansion.

It is not only the unexpected cataclysmic event in the politico-economic sphere that may upset the forecasts of the educational planner. There may also be less dramatic intensification or reversal of relevant social trends such as migration or fertility, propensity for pupils to enter, stay on in, or drop out of school, enrolment in

private schools, examination pass rates and so on. The resignation and re-entry rates of teachers themselves are clearly vital to the planner's equations, but in few countries are the explanations of the present level of wastage or variations in the level over time fully understood. A change of one or two percentage points in the wastage rate applied to the teacher stock represents a difference of very many additional teachers required or not required.

One should always recognise that the educational planner's projections depend as significantly on the assumptions used as on calculations. The public has the right to expect that the planner's calculations will be computationally correct and that the trend information on which the projections are based will be of as high a quality as can realistically be achieved in the conditions of data availability in the country concerned. But in the last resort, even with a valid information base and considerable computational skill, the projections will be no more reliable than the assumptions built into them; and these assumptions largely concern somewhat unpredictable human decisions and behaviour.

This suggests that certainty is going to elude the educational planner. Rather than attempting to get the demand-supply sums exactly balanced all the time—an impossible dream—he must plan for more than one possible future. Therefore, first, his forecasts of teacher demand and supply should not be expressed as single-value figures, but should rather give a range of possible values (e.g. a low, middle and high projection) according to different stated assumptions. Second, constant monitoring and adjustment of the forecasts should be undertaken.

Third, it will be wise to build into the teacher supply system itself options which may be exercised speedily in response to changing circumstances. To the extent that flexible capacity can be created, one is more likely to avoid excessive shortages or surpluses of teachers. What does 'flexible capacity' mean in practical terms? It means providing teachers versatile enough to teach, say, both mathematics and chemistry, and able to switch from one to the other full-time; 'polytechnic' colleges with a range of courses and flexible course structures which facilitate student transfers between teacher training and other activities; colleges which can teach either, say, 4-year courses or 2-year courses, or may alternatively be used for in-service training; college buildings which can later if necessary be converted to secondary schools,

or to other higher-education purposes; flexible ages of teacher retirement; ability to draw on expatriate teachers to fill temporary gaps, and so on.

This involves avoidance of exclusive concentration on lengthy single-purpose specialization in courses, physical facilities or teachers. The college which can serve a second purpose, the teacher who can switch subjects or teach more than one, the course which can produce a serviceable teacher in one year, should form a significant part of the resources available. Where there is the possibility of tapping reserve capacity it will be worth while keeping options open and emergency plans in stock (e.g. a register of trained teachers who might be willing to return part-time or full-time, contacts with foreign and international supply agencies, a knowledge of buildings potentially available for emergency training purposes). There is no gainsaying that just as in ordinary life insurance costs money, so in manpower planning maintenance of flexibility and room for future manœuvre cost money and some loss of specialist efficiency in the short term. Insurance premiums have to be paid. Since those responsible for teacher planning can neither accurately foresee nor closely control the future, they will be well advised to devise their own version of the insurance policy.

Measures to achieve balance

The educational planner who is faced by actual or anticipated surpluses or shortages of teachers should closely examine the factors causing the imbalance and consider ways in which it may be corrected. As we saw in Chapters III and IV, there are many different determinants of the level of teacher demand, and many different sources of teacher supply. Although adjustment of teacher-training output is one of the most direct ways of closing the gap between supply and demand, it is by no means the only way. Many other measures could be contemplated, which include for example the regulation upwards or downwards of school intake and enrolment, changes in the way teachers are deployed in schools and in pupil-teacher ratios, changes in the definition of who is an acceptable teacher, new policies in relation to teacher retention and loss, different policies on replacement of temporary teachers and on attraction back of teachers who have resigned. Even as regards teacher training itself, it is not just alterations in the size

of the system that should be considered. For as was noted in Chapter IV, different flow rates of teacher output can be obtained from a college system of any given size, by adjustment of the average length of courses.

At the end of this chapter, on pages 75-79, a listing of the various areas of possible action on the demand and supply of teachers has been attempted. The reader should understand that the author is not advocating all or any of these measures for adoption in particular countries. They are no more than points at which policies *could* be applied in the event of teacher shortage or surplus. Choices of particular options would clearly depend on the political, economic and social philosophies and circumstances of each country.

Indeed it must be stressed that achievement of demand/supply balance is only one objective of the educational planner. This objective should normally be subsidiary to the major goals set by a country for the education system. It may make little sense to achieve a teacher demand/supply balance at the cost of, say, drastically lowering teacher qualifications and increasing class size, if by so doing one imperils the prime goal of enabling pupils to learn effectively and well. It should be clear from the above that the demand/supply balance may in fact be struck at many different levels of demand, reflecting choices about levels of enrolment and modes of pupil-teacher classroom interaction: and that the supply target may be achieved by a wide variety of alternative measures in the areas of teacher training, alternative sources of recruitment, teacher wastage, etc.

In making its choices of measures to establish demand/supply balance, any government will naturally have regard amongst other things to political sensitivities. In case of teacher shortage, for example, it may be that a cut in school hours for pupils or the introduction of shifts might be unacceptable, whereas an increase in class sizes or employment of teachers of lower qualifications would perhaps excite less public criticism. Similarly, in the event of teacher surplus, it may not be possible to close teachers' colleges or lay off teachers: career commitments to existing personnel and concern for morale may incline governments to seek softer options —allowing some overstaffing, deliberately choosing to run twenty institutions below capacity instead of twelve at full capacity, and so on.

Because of the need to honour commitments to personnel once employed, and the much greater difficulty of laying off an existing teacher than of hiring a new one, it seems wise consistently to aim somewhat on the low side in planning teacher supply. A teacher once employed represents an ongoing financial commitment which must be met year after year. Rich countries with too many teachers can find ways of dealing with the problems of absorbing (or laying off with compensation) too many teachers: but poor countries cannot afford this luxury. It is nearly always possible on the other hand to make good any small shortfalls with temporary teachers having reasonable levels of general education. Moreover, since needs change and knowledge expands and develops, one needs sufficient 'play' in the teacher force to allow the recruitment of new kinds of specialists and to alter the balance of the existing stock. If the inflow of new teachers falls to a very low point, redistribution of the teaching force either geographically or in terms of subject and other specialisms becomes difficult and overall management of the teacher force becomes virtually impossible.

MEASURES COUNTERACTING TEACHER DEMAND/SUPPLY IMBALANCE

AREA OF ACTION	POLICIES/PRACTICES with EFFECT of	
	Reducing teacher SHORTAGE	Reducing teacher SURPLUS
I DEMAND FOR TEACHERS	**DEMAND-RESTRAINING MEASURES**	**DEMAND-BOOSTING MEASURES**
1. *Numbers to be educated*		
Education structure		
— Length of stages	Shorten, by eliminating grades	Lengthen, by adding grades
— Age of entry	Raise	Lower
— Age of leaving	Lower	Raise
Supply of schooling and participation rates		
— Compulsory education	Reduce length/fail to introduce/do not enforce law	Extend, introduce, enforce law
— Geographical accessibility of schools	Restrict	Improve (extend school network, transport provision)
— Education charges	Impose school fees	Remove fees and help parents with indirect costs of schooling
— Course admission	Control by selection	Open, at option of pupil/parents
— Re-entry	Forbid	Allow
— Repeating	Forbid	Allow

— Part-time attendance	Forbid	Allow
— Adult education	Discourage	Encourage
2. *Education technology*		
Average size of class	Increase	Reduce
Weekly input of teacher hours per class	Limit, by providing — fewer options — less practical work — fewer individual tutorials — less remedial work	Increase, and provide — more options — more practical work — more individual supervision — more remedial work
Pupil hours	Reduce relative to teacher hours, e.g. by half day schooling, shifts, etc.	Lengthen relative to teacher hours, abolish shifts, etc.
Teacher hours		
— Teaching load norms per individual teacher	Increase	Reduce
— Overtime (in excess of norm)	Encourage, require	Ban, discourage
Teacher-pupil ratios (staff allocations/establishments for schools)	Reduce, restrain	Increase
3. *Non-teaching jobs in education*	Limits such posts. Close to teachers, discourage teacher applications, encourage other applicants	Expand such posts. Open to/reserve for teachers; encourage teacher applications, discourage others

AREA OF ACTION	POLICIES/PRACTICES with EFFECT of	
	Reducing teacher SHORTAGE	Reducing teacher SURPLUS
II SUPPLY OF TEACHERS	**SUPPLY-BOOSTING MEASURES**	**SUPPLY-RESTRAINING MEASURES**
1. *Adjust outflows*		
Normal attrition		
(a) Retirement	Postpone, discourage	Encourage early retirement
(b) Resignation	Discourage	Tolerate, encourage
— Pay, allowances	— Increase	— Allow to fall behind other occupations
— Promotion prospects	— Improve	— Allow to decline
— Bonding	— Introduce, enforce	— Abolish, fail to enforce
— Rights on transfer (pension rights, contributions)	— Rights forfeited	— Rights retained
— Retention of young mothers in teaching	— Provision of crèches, nursery schools	— No special help
(c) Temporary absence	Restrict, reduce length	Facilitate, easy extension
— Secondments	— Fewer	— More
— Study leave	— Less	— More
— In-service training/retraining	— Less	— More;* particularly encourage retraining in shortage subjects/ specialisms

— National military service — Service abroad	— Exemption for teachers — Discourage	— No exemption — Encourage, with secondment arrangements
Replacement of unqualified expatriates	Cease, slow down	Introduce, accelerate
2. *Adjust inflows*		
Return from secondment	Encourage	Discourage
Initial training		
— Number of places	Build new colleges, expand existing ones	Close colleges, reduce places
— Conversions	Convert other buildings to teacher training	Convert colleges to other purposes
— Course structures	Make colleges monotechnic, teacher training only. No transfer opportunities to other courses	Provide teacher training in polytechnic institutions with provision for non-teacher-training courses and transfer possibilities
	Specific teacher training to start from first year of course	Postpone career choices. General basic courses leading to alternative vocations
	Teacher training places reserved for initial training.	Devote teacher-training places to in-service training as well as initial training.

* Note the *double* effect that full-time in-service training or retraining may have in reducing a teacher surplus. It *both* removes already trained teachers from the classroom, making room for others to be appointed, *and* at the same time uses up college training places which might otherwise be producing additional newly trained teachers.

AREA OF ACTION	POLICIES/PRACTICES with EFFECT of	
	Reducing teacher SHORTAGE	Reducing teacher SURPLUS
Initial Training (Cont.)		
— Length of courses	Shorten, develop emergency schemes, 'crash courses'	Lengthen. Provide regular courses only
— Part-time training	Introduce, using correspondence, on-the-job training	Abolish/restrict; insist on college attendance
— Training inducements	Offer attractive financial inducements/support to training students	Remove, or limit application of financial support
— Admission standards	Lower	Raise
— College drop-out	Act to reduce	Tolerate
— Graduation exam standard	Lower	Raise
— Re-sitting final examinations	Allow, but out of college	Disallow; or, if allowed, use up college places for these repeaters
— Bonding of graduates to enter teaching	Introduce, enforce	Tolerate new trainees entering other occupations
Re-entrants	Encourage, by inducements, preservation of rights for time away, etc; offer possibility of part-time teaching	Discourage; no favourable treatment on re-entry; no part-time teaching

Unqualified teachers		
— Definition	Remove/reduce professional entry qualifications	Impose/raise professional entry qualifications
— Recruitment policy	Recruit and improve their conditions of service	Cease recruitment, discourage
— Temporary licences to teach	Make freely available	Restrict issue
Military/national service teachers	Use national servicemen for teaching	Do not use national servicemen for teaching
Foreign teachers		
— Recruitment	Facilitate	Impede (refuse work permits)
— Recognition of foreign qualifications	Grant readily	Refuse

VI. Planning for a differentiated teacher force

The discussion of teacher demand and supply has so far been in terms of the total teacher force and overall teacher-pupil ratios. If teachers and teaching jobs were completely undifferentiated, it would be satisfactory to work at this aggregate level, for teachers would be infinitely substitutable for each other. In fact, however, teaching jobs are to some extent differentiated and many of them can be performed only by teachers with certain characteristics. The market for teachers is not one unified market, but a collection of partially self-contained smaller markets.

For example, in some countries it is not acceptable for girls to be taught by male teachers; and in these circumstances it is obviously necessary to calculate demand and supply separately for males and females. Again, if primary education may be taught through different media of instruction, it is important that there be demand/supply balance of teachers in each of the main language groups. In India a Hindi-speaking teacher may not be able to take classes in Bengali, nor in Ethiopia may a Galla teacher be able to take classes in Amharic. In other words, what one may very easily find is that an overall demand-supply balance conceals some severe imbalances in respect of particular types of teacher.

Demand and supply of subject teachers

The most obvious way in which the teacher market is subdivided is in terms of teaching subjects at secondary and higher levels. At the higher levels of the education system, knowledge and skills are rather specialised and the individual teacher's expertise is normally

limited to one or two subjects. In many countries an overall surplus of teachers in fact represents an excess of humanities and social science teachers and conceals a serious shortage of mathematics, science and language teachers.

How can demand and supply of teachers be calculated on a subject basis? On the demand side, it is necessary to break down total demand into subject categories. Table 5 illustrates how this may be done, starting from typical curricula in different types of educational institution and their embodiment in a weekly timetable. This enables one to calculate the proportion of total time allocated to each curriculum specialism and so to arrive at the staffing requirements of a model school of standard size. One can use this information in conjunction with plans for future school development to estimate the number of full-time-equivalent teachers needed for each area of the school curriculum. It may well be that the country concerned has different types of secondary school—theoretically inclined academic secondary schools on the one hand and practically biased secondary technical or secondary commercial schools on the other. The individual subject components of the curriculum may vary between these types. In such a case government development plans for the different types of secondary school will have to be consulted in order that teacher needs can be reckoned for each. These requirements can then be totalled to produce stocks of, say, mathematics and language teachers needed at successive future dates. This can be converted into flow projections for the different subject groups of teachers, taking into account the existing and projected supply.

Such in broad outline is the approach to be followed in calculating needs for subject teachers, but a number of potential difficulties ought to be mentioned.

(i) A minority of countries have no prescribed timetable with subject allocations applying to all schools; rather it is left to the discretion of each school to decide its school subject offerings (e.g., in England and Wales). Even where the curriculum is centrally prescribed, there may be provision for options (languages, practical subjects etc.) the choice among which may vary between schools according to their location and facilities. Therefore it will often be necessary to make a survey of actual curricular practice, and the distribution of optional subjects, as the basis for constructing a typical curriculum to be used in forecasting subject teacher needs.

Table 5. Illustrative calculation of subject-teacher requirements at secondary level.

	School timetable (periods per week)						Total 1980 teacher requirements (full-time equivalent teachers)		
	General secondary schools			Technical secondary schools					
	1	2	3	4	5	6	7	8	9
		Average school (16 classes)			Average school (24 classes)				
Teaching subject	Typical individual weekly timetable (no. periods)	Total weekly periods taught (col. 1 × 16)	Teachers required (32 periods per teacher)	Typical individual weekly timetable (no. periods)	Total weekly periods taught (col. 4 × 24)	Teachers required (32 periods per teacher)	General secondary schools 180 standard units (col. 3 × 180)	Technical secondary schools 14 standard units (col. 5 × 14)	All secondary schools (cols. 7 + 8)
National language	6	96	3	6	144	4.50	540	63	603
Local language	4	64	2	4	96	3	360	42	402
Foreign language	4	64	2	—	—	—	360	—	360
Religion	2	32	1	2	48	1.50	180	21	201
Social studies	6	96	3	—	—	—	540	—	540
Art	1(½)	24	0.75	—	—	—	135	—	135
Music	1(½)	24	0.75	—	—	—	135	—	135
Mathematics	6	96	3	9	216	6.75	540	94.50	634.50
Sciences	6(2)	128	4	10(6)	384	12	720	168	888
Agriculture	3(2)	20	0.60	8(4)	24	0.75	112.50	10.50	123
or Commerce		10	0.30		96	3	56.25	42	98.25
or Industrial arts		30	0.90		132	4.13	168.75	57.75	226.50
or Home science		20	0.60		36	1.13	112.50	15.75	128.25
Physical education	1	16	0.50	1	24	0.75	90	10.50	100.50
Total	40(5)	720	22.50	40(10)	1 200	37.50	4 050	525	4 575

NOTES
1. Figures in brackets represent teaching periods spent in half-classes (for practical work etc.).
2. Although in the case of practical subjects an equal amount of time is allocated to each option, the number of pupils taking the options is assumed to be unequally split among them; hence the 'average school' shows different amounts of time expended on the various options.
3. The actual number of schools of different sizes has had to be converted to standard-size-equivalents (cols. 7 & 8), in order that the model unit at cols. 2 + 3 and 5 + 6 can be used as the basic for calculation. In a rapidly expanding system there will be many developing schools of smaller than standard size.
4. Average teaching load is assumed in this example to be 32 periods per week.

(ii) Even where the subject allocation for individual streams or types of school has been laid down, the distribution of students between the different streams may be uncertain, either because this is left to student choice, or because national targets for the distribution of students cannot be implemented. The failure of many countries to achieve their announced intentions to increase the proportion of students in science and technology is well-known. In part this is undoubtedly due to difficulties on the supply side, particularly teacher shortage; but in some countries it also reflects student preferences and student performance in science. The realism of the plans for distribution of students by subject specialisms needs therefore to be closely examined, and the possibility of shortfalls allowed for.

(iii) There is the problem of anticipating curriculum change. Sociology or economics or computing would not have appeared on school timetables twenty years ago, whereas now they are not uncommon.

(iv) When the aggregate demand for the teaching of a subject is converted into numbers of individual teachers, a number of awkward distributional problems arise, in the case of minority subjects, from the fact that many schools are small and scattered. This makes it difficult for such schools to keep a teacher of a minor subject busy on a full-time basis, unless that teacher also handles other subjects. Suppose, for example, that music is taught for one period per week (out of 40) to all secondary-school pupils. Using the method of calculation suggested above, a secondary-school system with 300 schools and 6,000 teachers could be reckoned to need 150 full-time teachers (i.e. one-fortieth) for music. However, the average requirement for each school is for half a full-time teacher of music (300 schools, 150 full-time teachers). Yet *each* of the 300 schools needs some teaching of music if the standard curriculum is to be applied uniformly everywhere. The actual distribution might be on the lines shown in Table 6.

In the example given in Table 6 it is clear that the 300 schools need only 150 full-time equivalent teachers of music, but because of the distribution of schools, even allowing for the sharing of part-time teachers, this will require 250 individuals able to teach music (80 full-time, 110 half-time and 60 quarter-time). If in this example part-time employment of teachers was not permitted,

Table 6. Illustrative data on staffing schools in minor subjects.

School size	(number)	Average no. teachers per school		Total music teachers	
		Total	Music (1/40)	FTE[1]	Individuals
Large	(20)	80	2	40 40	
Large-medium	(10)	40	1	10 10	
Small-medium	(130)	20	½	65 { 30 / 70	full load (2 sch)[2] / half load
Small	(140)	10	¼	35 { 40 / 60	half load (2 sch)[2] / quarter load
Total	(300)	20	½	150 250	

1. FTE = full-time-equivalent teacher.
2. These teachers would make up their teaching load by working at two neighbouring schools for part of the week each.

two-thirds (170 out of 250) of the music teachers would have to teach other subjects as well.

(v) There may not in all cases be an exact correspondence on a one-to-one basis between the subject of a teacher's training and the subject he is teaching in the classroom. There may be no special option in the teacher-training system corresponding to some subjects on the school timetable (such as civics, for example?) and these subjects will naturally have to be taught by teachers with other specialisms. Second, even where appropriate courses do exist, absolute shortages of trained teachers in some subject areas force teachers to go outside their specialism. Third, poor distribution of teachers between schools (due perhaps to inefficient posting by the authorities) may force a teacher to teach subjects other than his own, because trained teachers of his subject are already on the staff of the institution to which he has been assigned. To meet these problems, some countries have introduced the requirement that teachers specialise during their training in more than one subject. This practice helps to meet the problem of staffing minority subjects (as discussed above), and provides much needed flexibility in the deployment of

teachers; but it does of course introduce ambiguities into the classification of teachers by subject as a basis for planning teacher supply.

(vi) In view of the above, it becomes very important in estimating subject teacher demand and supply to know how teachers are actually used, and the extent to which actual supply (actual teaching assignment) represents potential supply (subjects of training). In a subject-based system the teacher trained in Chinese who is actually being asked to take mathematics classes should properly be treated as an unqualified teacher of mathematics, and represents 'wastage' from the trained cadre of Chinese teachers.

Geographical distribution of teachers

A second common type of imbalance is geographical, either inter-regional or inter-school, with some areas and schools being short of teachers overall, or of particular kinds of teachers, even though there may be balance between demand and supply at national level. The local imbalance may arise from purely historical factors—those regions where expansion of education started late, but is now proceeding rapidly, may have fewer well-qualified and experienced teachers. If such areas happen also to be physically inaccessible, climatically unattractive or set apart culturally from the rest of the country, such problems may persist over a long period.

The long-term solution, bearing in mind that people are generally more willing to work in their own home areas, may be to establish teacher-training facilities locally, and to reserve places in these for local students. It may be necessary to do this on a discriminatory basis, positively favouring local students against better-qualified outsiders; for otherwise the places will be taken by students who have no intention of serving in schools in the vicinity of the college after their graduation. Very probably it will also be necessary, at least temporarily, to bond students at these colleges to a period of service in the locality, since even students native to the area may be attracted by employment opportunities elsewhere.

Even in the longer term, however, such measures may not be sufficient and it may prove necessary to supplement them by policies

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designed to channel already trained teachers from popular areas into less advantaged regions and schools. This may be done by direction, or by a system of incentives, or by a combination of the two. A system of direction may impose on teachers the obligation to serve wherever they are posted, and to transfer between posts only with official authorisation. Such systems may create a good deal of resentment unless there are built-in safeguards to limit the time that any individual teacher has to serve in difficult posts and to ensure that the burden of hardship postings is equally shared. It also tends to concentrate enormous power in the hands of the bureaucracy responsible for postings: connections and influence become important, and accusations of improper influence and corruption may be rife. If, alternatively, a system of incentives is used, teachers are allowed to apply for posts, but the financial and other rewards attaching to the post influence their choice. Designated posts may, for example, attract special 'hardship allowances' in cash or amenities in kind, such as free housing and transport. The rewards may not necessarily be immediate—it may be that service in a designated post can be used as a prerequisite for promotion, or may accelerate one's entitlement to promotion.

Whichever system is used, direction or incentive, it is essential for fair distribution of teachers that some staff establishment formula for schools be instituted, with built-in mechanisms for ensuring equity between schools. The staff establishment formula should specify not only total numbers of teaching posts but also numbers of senior posts (headmaster, deputy headmaster, head of department, etc.), for schools of each type and size. If pay is attached to these posts rather than to the person of the teacher, this will contribute to the more equitable distribution of teachers. Thus even a highly qualified teacher would be able to draw an attractive salary only if he filled a senior post; and the availability of unfilled senior posts in remote areas, whilst only junior posts were available in the capital city, would help to draw teachers away from the more popular to the less popular locations. If teachers can always draw exactly the same salary in their present post in the town as by moving to the countryside there is little incentive for them to move.

Payment for responsibility rather than qualifications also has another, even more important, advantage. It helps to limit the pace of cost inflation in education. This is because the ratio of senior posts to total posts can be administratively controlled over the long

term much more easily than the proportion of better-educated teachers in the total teaching force.

If, however, level of qualification is to be the main criterion used in fixing teacher pay, one approach to ensuring fair teacher distribution is to impose a quota on the proportion of better qualified teachers that any one district or school may employ. The authorities might for example stipulate that not more than three-quarters of any school's staff may be trained, or that not more than half the trained teachers are to be university graduates.

VII. Making teacher projections in practice

On reaching the end of this volume, many practising planners will perhaps be looking for more specific guidance on the steps they should take to calculate future teacher requirements and teacher supply. Although, as stated in the Introduction, this is not a manual on making projections, it may be useful to consider briefly how a practising educational planner might construct a teacher 'balance sheet' highlighting for his country's policy-makers the present and future teacher demand and supply situation, and pointing to some of the policy options available.

A purely illustrative calculation for an imaginary country facing a teacher shortage is presented in Table 7. The teacher model it contains is perhaps the simplest one can imagine, being for a uniform type of primary school, having only one category of qualified teacher. The basic data requirements to draw up a table of this kind are really very simple. The following steps are required in compiling it (the numbers below correspond to the numbered steps in the table).

1. Enrolment projections

The actual level of enrolments will be known either for the current year or, if such recent data are not yet available, probably for last year or the year before last. Enrolment in future years is largely predetermined by current enrolments as affected by attrition. The two major assumptions that have to be made concern (i) the level of future enrolments at Grade 1—a relatively easy calculation if compulsory education is in force with a fixed age of entry and if repeating is insignificant, but more problematical otherwise, and

(ii) changes in wastage rates affecting present enrolments and future intakes. Both intake levels and wastage will be subject to a combination of factors, some within government control and subject to policy decisions, and others not. The projections must take account of government policies for the future, as already announced or in the pipeline. If government has no settled plans or policies, it may be necessary simply to extrapolate past trends.

2. Pupil-teacher ratios

Once enrolment figures have been projected, the required number of teachers can be calculated by applying a pupil-teacher ratio. In Chapter III we saw that the pupil-teacher ratio is a deceptively simple expression of what may be extremely complex practices of teacher use. The planner normally has at his disposal, or can easily calculate, the trend of the pupil-teacher ratio in recent years, and may decide simply to project these into the future. In so doing he will bear in mind the extent to which urbanisation may make higher pupil-teacher ratios feasible; and conversely the contrary possibility that extending schooling to ever more remote rural communities would have the opposite effect. In other words unchanged policies in respect of teacher use will have varying effects on the pupil-teacher ratio according to trends in population density and school sizes. The planner will also take into account government policy on teacher use. Any intention to alter teacher loads, class sizes or pupil hours will require adjustment of the ratio, and of staffing norms for schools.

3. Total demand

The total requirement (stock) for teachers at successive future dates can easily be obtained by dividing the figure for pupils per teacher into anticipated future enrolment.

4. Stock of acceptable teachers

The definition of 'acceptable teacher' will vary from country to country. In the example, it is assumed that professionally qualified nationals are all acceptable, but others not: in the illustration only 60 per cent of teachers are regarded as acceptable in the base year. The national education statistics, or teacher service records, should give an accurate picture of the current teacher force and the numbers who are qualified nationals. In future years the stock is calculated by adding net flows to previous stocks.

Table 7. Illustrative projected teacher demand/supply balance sheet 1980-85

Steps in calculation	1980	1981	1982	1983	1984	1985
	Actuals	Projections				
Demand						
1. Projected enrolments	502 350	542 480	576 120	606 220	633 850	656 540
2. Pupil-teacher ratio	34.15	34	34	34	34	31
3. Total teacher demand (1÷2)	14 710	15 955	16 945	17 830	18 643	21 017
Supply						
4. *Stock:* acceptable teachers (qualified nationals), carried forward from last year col. 6)	8 924	9 593	10 205	11 071	12 223	13 516
5. *Flows* during year, modifying last year's stock						
a. deduct net wastage since last year (gross wastage net of re-entry)	−215	−288	−306	−332	−367	−405
b. add new qualified entrants from last year						
i. new college output	+869	+880	+1 152	+1 264	+1 440	+1 624
ii. in-service qualifiers	+15	+20	+20	+220	+220	+220
6. Total teacher supply in current year (4+5)	9 593	10 205	11 071	12 223	13 516	14 955
Balance						
7. Size of shortfall (3 − 6)	5 117	5 750	5 874	5 607	5 127	6 062
8. Shortfall covered by:						
a. teachers in training (1 year probation)	—	—	2 000	2 000	2 000	2 000
b. trained teachers not yet qualified	160	180	210	240	270	310
c. national servicemen (2-year service)	—	—	—	1 000	2 000	2 000
d. foreign teachers—qualified	38	30	20	10	—	—
e. foreign teachers—unqualified	2	—	—	—	—	—
f. vacant posts	45	—	—	—	—	—
g. untrained teachers (residual)	4 872	5 540	3 644	2 357	857	1 752
(TOTAL)	(5 117)	(5 750)	(5 874)	(5 607)	(5 127)	(6 062)

This illustrative trial 'balance sheet' for an imaginary country is intended merely to indicate how an educational planner might work out and present his calculations. For any real country the 1980 actuals, ratio of change 1980-85 and all the assumptions concerning pupil-teacher ratios, wastage etc. would of course be different. The country chosen suffers from a severe shortage of qualified teachers and wants to replace those without training (8g). In fact this would be achieved in 1985 if it were not for the intention to drop the pupil-teacher ratio from 34:1 to 31:1. The teacher-training system has been expanded to the point where it can take care of growth in enrolment (excluding further changes in pupil-teacher ratios) of about 700-1000 teachers p.a., plus expected wastage (rising to 780 teachers p.a. when all teachers are qualified). The introduction of a probationary year (8a), national service (8e) and 3-year in-service courses for unqualified teachers (5b) will all help to reduce the number of unqualified. The balance sheet is described as 'trial' in so far as it indicates where government's present policies are tending. If the anticipated future situation is not acceptable to government, then new policies which effectively change the assumptions for lines 1, 2, 5 and 8 will have to be introduced.

ASSUMPTIONS

Line 1. Based mainly on projection of existing Grades 1-6 enrolment, using existing wastage rates. New intakes assume rising enrolment ratio of seven-year-olds who increase at 2.85% p.a.

2. Actual number of pupils and teachers 1980 give PTR of 34.15:1. PTR of 34 assumed to continue to 1985 when each complete primary school to receive one extra teaching post.
3. Total projected teaching posts, whether filled by qualified or unqualified. 1980 figure is actual teacher stock.
4. 'Acceptable teachers' assumed to be qualified nationals; 8924 in 1980 col. is in fact number of qualified nationals in primary schools in 1979.
5. (a) Net wastage 1979-80 calculated from actuals, and gives 2.4% wastage. For later years 3% assumed. Net wastage = loss from all causes, less all qualified re-entry.
   (b) (i) College enrolments assumed to expand and 85% of final-year students enter primary schools as qualified teachers, (ii) 300 unqualified teachers to be enrolled from 1980 on 3-year in-service course, of whom 220 p.a. expected to complete.
7. Posts vacant or filled by unqualified teachers.
8. *a.* From 1982 probationary year to be required of would-be entrants to teacher-training courses. If this scheme continues places in teacher force must be permanently reserved for them.
   b. Approx. 10% of college students assumed to fail exams and to serve as unqualified teachers while waiting to re-sit.
   c. Two-year national service scheme for 1000 entrants p.a. with completed upper secondary education to be introduced as emergency measure in 1983.
   d. & *e.* Assumed to be phased out.
   f. In 1980 45 vacancies actually exist, but it is assumed good management will avoid this in future.
   g. This category regarded as residual and major policy aim is to reduce proportion of unqualified teachers.

5. (a) Net wastage

In a system with fully comprehensive education statistics it is possible to construct a complete flow model in respect of the teacher force of the kind illustrated in Table 8. Unfortunately, however, the only data on teacher flows that are regularly kept by the authorities in many countries are those on inflow from initial teacher training, and even here the data are for college outputs rather than for intake to the profession (i.e. there is often no record of the number of newly trained teachers who actually take up their assignments). Information should be available from personnel records of the number who die, retire or resign; but unless there is a regular system for retrieving this information, it may never be analysed and presented in statistical publications.

In consequence, in their educational planning very many countries find themselves having to reduce inflows and outflows to just two categories, of which one is 'new output from the colleges', while the other is a catch-all item 'net wastage'. 'Net wastage' covers gross outflows of all kinds less returners and re-entrants. The rate of net wastage is not difficult to calculate if one has reliable data on successive years' qualified teacher stocks and on new intake of freshly trained teachers to the system. One can then reckon that:

Net wastage rate (per cent) =

$$\frac{\text{Last year's stock} + \text{new intake} - \text{this year's stock}}{\text{Last year's stock}} \times 100$$

Taking figures for 1979 and 1980 from Table 7, and applying the formula, the net wastage rate would be

$$\frac{8924 + 884 - 9593}{8924} \times 100 = \frac{215}{8924} \times 100 = 2.41 \text{ per cent.}$$

The net wastage rate projected for years after 1980 in Table 7 is 3 per cent, but there will be countries where appropriate figures would be much higher than this, and in other cases lower.

It should be noted that projections of net wastage rates are difficult to make and very liable to error. This is because the net wastage rate is a composite figure covering a variety of different inflows and outflows. To project the net wastage rate without knowing the size and direction of change of its constituent parts can result in seriously wrong forecasts.

Table 8. Teacher flows: an illustration for qualified public primary system teachers

1979 Stock	1979 Outflow	Type of teacher flow 1979-80	1980 Inflow	1980 Stock
	− 16	Death	—	
	− 46	Retirement	+1	
		Resignation/re-entry		
	101	—other jobs	29	
	71	—marriage/domestic	33	
	5	—migration abroad	2	
	−177		+64	
	−1	Dismissal	—	
		Moves within education		
	19	—administrative work	—	
	19	—teaching other levels (secondary, nursery, etc.)	2	
	2	—private sector teaching	3	
	− 40		+5	
		Temporary transfers		
	60	—In-service training and re-training	55	
	22	—study leave	29	
	15	—maternity, sick leave	4	
	1	—secondment other work (incl. abroad)	5	
	− 98		+93	
		New production		
		—college initial training	841	
		—resitting initial training examination	28	
		—qualifying through up-grading course	15	
	—		+884	
8924	−378 (=8546)		+1047	= 9593

NOTE The stock of teachers in 1980 consists of:

8546	(89%) retained from 1979
163	(2%) re-entrants of various kinds
884	(9%) newly qualified
9593	(100%) total

Gross wastage on the 1979 teacher stock (of 8924 teachers) is shown to be 378 (4.2%). Net wastage on the 1979 teacher stock is 378 minus 163 re-entrants, i.e. 215 (2.4%).
Growth of (net addition to) the teacher stock between 1979 and 1980 is equal to new output (884) less net wastage (215), that is 669 teachers.

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5. (b) New qualified entrants
These will be of two kinds: those who enter the teaching force as newly qualified teachers, and others—in systems where such provision is made—who as unqualified teachers gain qualified status through courses taken while on the job. As already indicated, records of college output are normally available, but not of actual entrants to the teaching service. Numbers obtaining qualified status by in-service routes (or by re-sitting college examinations having previously failed) may not be regularly reported. For accurate forecasting such information is needed.

6. Total teacher supply
This in fact represents total acceptable teachers.

7. Shortfall/surplus
This represents the excess of demand over the supply of acceptable teachers.

8. Measures to cover shortfall/surplus
The gap (a shortage in this instance) is in fact the gap between demand and supply of *acceptable* teachers. The gap will not generally be allowed to appear as vacant teaching posts: usually some temporary stop-gap arrangements, involving the use of substitutes to close the gap, will be entered into. The most common are the employment of underqualified national teachers, the use of teachers from abroad, or resort to temporary schemes of national service.

If the gap between supply and demand was in fact a surplus of supply, the items against heading no. 8 would be a schedule of ways of absorbing the surplus. These might include overstaffing of schools above the target teacher-pupil ratio, secondment of teachers to other jobs or other countries, and a large pool of teachers on in-service courses, or teacher unemployment.

It should be noted that the gap is defined here by reference to a particular target pupil-teacher ratio. Teachers who are 'surplus' on the basis of this ratio, might well be making an important educational contribution in the schools through remedial and small group teaching. They would be truly 'surplus' in every sense of the term only if their presence added nothing to the educational services being provided in the schools. Similarly a 'shortage' shown by reference to the target ratio could be visible in terms of untaught

classes or partially disguised at school level by heavier teaching loads. In other words shortage and surplus as defined in relation to targets of output (enrolment) and target pupil-teacher ratios do not reflect the accommodations that may be made in the schools themselves.

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The book

Over the past two or three decades the demand for teachers has been at an unprecedentedly high level, and the educational authorities in each country have been hard put to it to staff their rapidly expanding education systems. In some countries enrolment growth is still accelerating, giving rise to ever greater teacher requirements; elsewhere, however, recent demographic and economic changes have brought about a levelling-off in the size of the teaching force needed, and a number of countries have been seriously embarrassed to find themselves unexpectedly in a situation of over-supply.

This study explores the factors determining the demand for teachers and teacher supply, and discusses the measures available to educational planners in their efforts to maintain and achieve balance. The author argues that creating capacity to respond to changed circumstances should be as much an objective of educational planners in this area as making accurate forecasts. He demonstrates that the managers of the teaching force, faced by incipient teacher shortage or surplus, have in fact a wide range of policy options open to them in the recruitment and deployment of teachers. While this is not an instructional manual on projecting teacher requirements, those whose responsibility this is will find useful advice in setting about their task.

The author

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ISBN 92-803-1079-4

VIII. Conclusion

On reaching the end of this volume the reader should have acquired a broad understanding of the underlying factors determining teacher supply and demand, and the way in which they may be calculated. He will understand the importance of trying to maintain a continuing balance between demand and supply, and should be aware of the wide range of influences and policy measures that may be brought to bear on securing that balance. He will realize that planning of teacher supply should involve far more than determining annual intakes to the training-college system; in addition to the wide range of alternative sources of recruitment that can be tapped, the factors affecting the retention and utilization of teachers will be just as central to the planner's concerns. The reader will also appreciate the vital importance of maintaining flexibility in the teacher supply system with a capacity to adjust to rapidly changing situations.

Understanding is a necessary basis for action, but what should a governmental authority at national, provincial or district level *do* to be in better control of its teacher supply situation? Two essential initial steps can be suggested.

The first prerequisite for effective planning is to set in order the system of collecting, recording and analysing data on the current teacher force, and on movements within, into and out of that teacher force. Unless there is an adequate data base in respect of teacher stocks and flows, attempts to plan will be futile. As a start details of the composition of the teacher stock should be refined, for if this is collected each year a comparison of the annual stock figures will already yield clues about inflows and outflows. But as soon as it is feasible the stock figures from annual school statistical returns

should be supplemented by a system of individual teacher records —in many countries merged perhaps with the computerized payment of salaries or the social security system—which will make available regular data on teacher flows.

The second need is for planning and co-ordination machinery. It will be helpful to identify particular officers who are to have responsibility for regular analyses of teacher requirements and the making of projections. This is a specialist task which may well be assigned to officers either in the planning unit of the education authority, or in the section or body responsible for the teachers' service. It must always be remembered however that planning involves liaison, information and persuasion in quite as full a measure as it requires technique and expertise. It is therefore imperative that some regular consultative machinery exist between those who make education policy (e.g. the Ministry of Education), those who employ and use teachers (e.g. the Teachers Service Commission, local authorities, school boards etc.), those who train teachers (training colleges, universities, higher-education institutes) and the teachers themselves (through their own unions and associations). This consultation will be all the more important in future if more teachers are trained in higher institutions and universities, enjoying some measure of autonomy from government. The need to inform, and, at a time when demands for participation in educational decisions are growing, to consult and involve members of the teaching profession, training-college staffs and the public at large will assume increased importance in teacher planning.